AUGUST

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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Exodontia and General Practitioner—*Feldman*
Preventive Prosthesis—*De Van*
Malocclusion—*Grieve*
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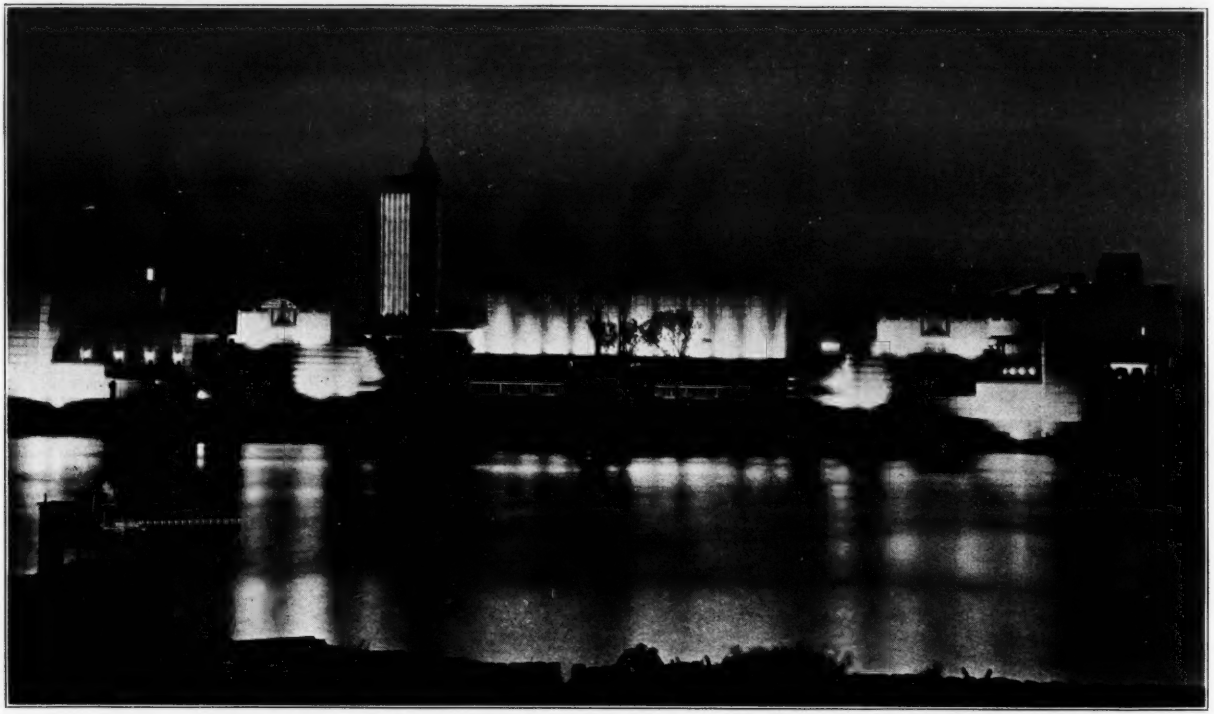

HALL OF SCIENCE, BY NIGHT; A CENTURY OF PROGRESS EXPOSITION

THE JOURNAL
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Original Communications

ANATOMY OF THE ROOT CANALS OF THE INCISORS, CUSPIDS AND BICUSPIDS OF THE PERMANENT TEETH*

By A. H. MUELLER, D.D.S., M.S., Chicago, Ill.

IN 1924, I observed that extracted teeth submitted by dental students for roentgenographic examination did not always reveal conditions that dental literature would lead one to expect. Several hundred teeth were therefore collected and roentgenographed in the usual labiolingual and buccolingual directions. In order to carry still farther the study of root canals, these same teeth were roentgenographed in a mesiodistal direction. The two films, mesiodistal and labiolingual or buccolingual, presented entirely new evidence. Variations of an unexpected and interesting kind were revealed, suggesting the possibility of securing new and useful data on the structure of the root canals.

Most of the available literature on the structure of root canals of the human teeth is to be found in textbooks. The early writings were not extensive. Mühlreiter[1] (first edition, 1870) was probably the earliest to study the subject with any thoroughness. In his research, he sectioned the teeth mesiodistally, labiolingually and buccolingually in the axial planes. He also cross-sectioned the teeth.

Black,[2] another early contributor to the subject, published the first edition of his work in 1890. The technic followed at this period consisted in attaching teeth to wood blocks and grinding them into sections, or in sawing them into sections.

Apparently the first man to digress from sectioning teeth, according to

*Read before The Odontographic Society of Chicago, Dec. 5, 1932.

1. Mühlreiter, E.: Anatomie des Menschlichen Gebisses, Leipsic: Arthur Felix, 1870.

2. Black, G. V.: Descriptive Anatomy of Human Teeth, Ed. 4, Philadelphia: The S. S. White Dental Manufacturing Company, 1902.

Hess,[3] was Preiswerk. In his study of the anatomy of root canals, Preiswerk employed a unique method. After exposing the pulp chambers, he placed the teeth in water in an incubator at a temperature of 30 C. for about three weeks. After this, he syringed a hot soda solution into the pulp chamber and canals in order to wash out the pulp tissue.

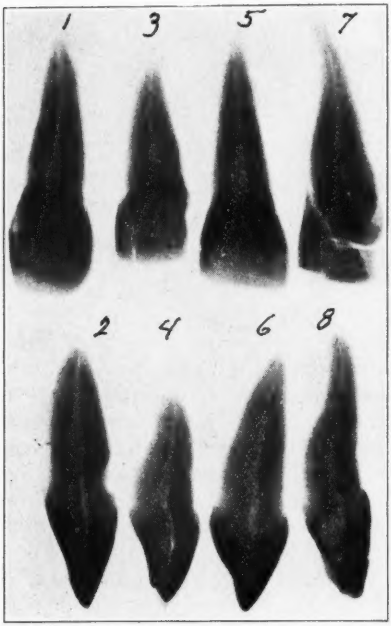

Fig. 1.—Upper central incisors with normal root canals.

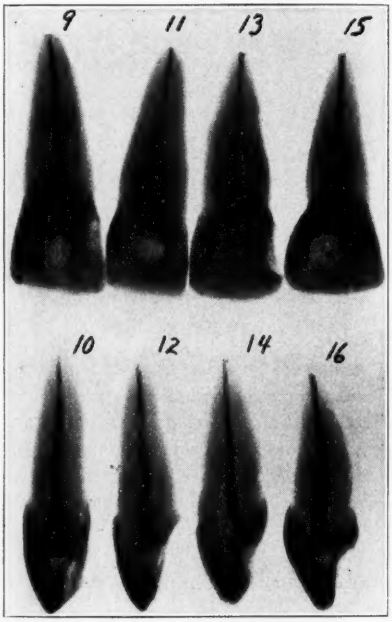

Fig. 2.—Upper central incisors showing normal canals.

Each tooth was dried in hot air, wrapped in filter paper and set in plaster of Paris. Over each tooth, he glued a cardboard funnel. The block of plaster was slowly heated in either a sand-bath or a water-bath until it was of the temperature of molten Wood's metal. Wood's metal was then poured into the funnels and the plaster was jarred to aid the metal in flowing into the canals. The weight of the metal in the cones also aided the flow into the canals. Preiswerk used caustic lye to decalcify the teeth. The casts were defective because the metal would not flow into the finer canals and foramina.

In 1907, Fischer[4] reported further progress, using celluloid instead of metal. He thoroughly opened the pulp chambers of extracted teeth and then placed

3. Hess, Walter: Zur Anatomie der Wurzelkanäle des Menschlichen Gebisses mit Berücksichtigung der feinern Verzweigungen am Foramen apicale, Schweiz. Vierteljahrsschr. f. Zahnheilk., Vol. 27, No. 1, 1917.

4. Fischer, Guido: Über die feinere Anatomie der Wurzelkanäle Menschlicher Zähne, Deutsche Monatschr. f. Zahnheilk., September, 1907.

the teeth in water at a temperature of from 31 to 37 C. for several weeks or months until he was able to syringe a soda solution through the canals by way of the pulp chambers. The teeth were then placed in running water for a day, after which time they were dried and immersed in absolute alcohol for twenty-four hours. After the alcohol treatment, they were transferred to pure acetone for several days. After the acetone treatment, each tooth was transferred to a test tube containing a weak solution of celluloid in acetone. These tubes were well stoppered for three days, after which time cotton stoppers instead of cork were used. The cotton permitted the acetone to evaporate. Each day, the tubes were filled with the solution of celluloid in acetone. After two or three weeks, during which time the celluloid hardened and turned a yellowish brown, the tubes were broken and the teeth carefully removed. Fischer used 50 per cent hydrochloric acid to decalcify these teeth. The celluloid penetrated all of the foramina of the pulp canals, and made exact casts of the canals of the teeth. But celluloid is brittle, and therefore the fine projections or casts of the foramina were easily broken.

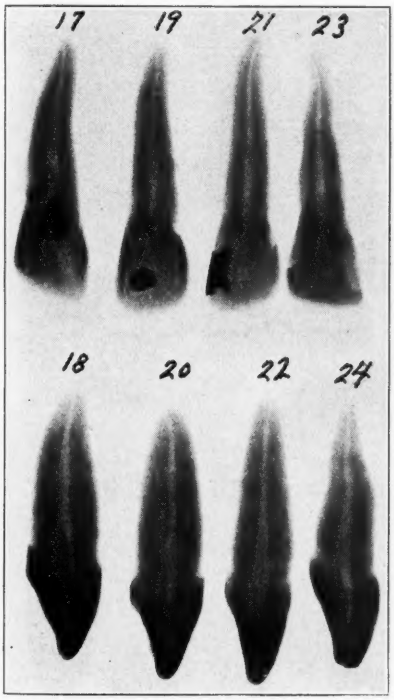

Fig. 3.—Upper lateral incisors with normal conical canals.

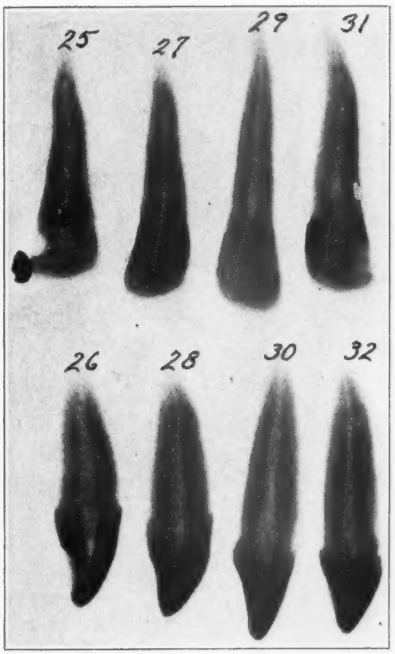

Fig. 4.—Upper lateral incisors showing pulp stone and round canals.

In 1917, Hess[3] wrote of still another method. His procedure was very thorough. Using, as had his predecessors, extracted teeth, he exposed the pulp

cavities, but did not enter the canals. He kept the teeth at a temperature of 37 C. for three or four months in a vessel filled with drinking water. At the end of that time, he could syringe through the pulp chambers with a soda solution, the temperature of which was 40 C. (He suggests that one may use an acid-free hydrogen peroxide solution instead of soda.) The teeth were then

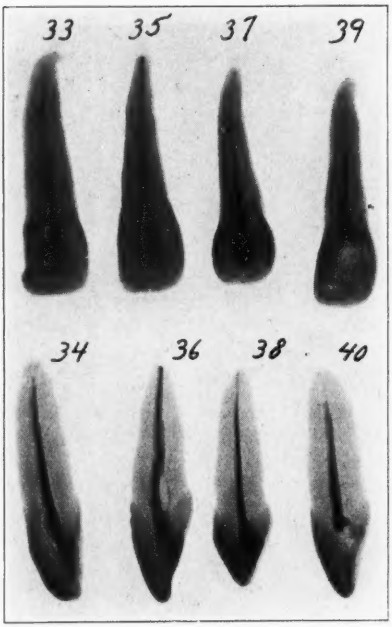

Fig. 5.—Upper lateral incisors showing pulp stone and sharp turn at apex.

placed in running water for twenty-four hours. They were then dried and placed in absolute alcohol for twenty-four hours, after which they were dried in room temperature for another twenty-four hours. He then wrapped each tooth in blotting paper, and embedded the roots and paper in plaster of Paris, in a dental vulcanizing flask, so that only the pulp cavities were exposed. In each pulp cavity, he placed vulcanite rubber. Over the vulcanite rubber, he sprinkled talc, which acted as a separating medium when the plaster was poured for the counter mold. After the plaster in the counter mold was hard, the molds were separated and the pulp canals and chambers packed with rubber.

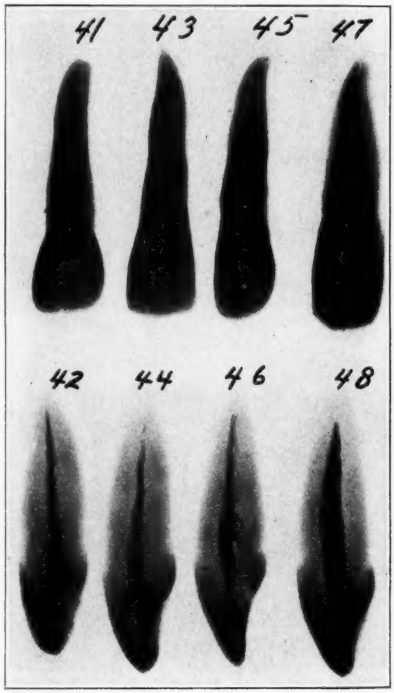

Fig. 6.—Upper lateral incisors showing irregular canals.

The method of packing the flask and vulcanizing is exactly the same as is used by dentists in vulcanizing artificial dentures. After the rubber was vulcanized, the teeth were washed in water and placed in 50 per cent hydrochloric acid. After the teeth were decalcified, they

were washed, the organic matter was removed from the vulcanite and the vulcanite specimens were mounted on plaster blocks. Of all writers on the subject, Hess seems to be the only one to give definite data as to how many teeth were used.

Instead of sectioning extracted teeth (grinding or cutting) or making casts of pulp canals in order to study their anatomic structure, the method used in the present study was to roentgenograph extracted teeth in the usual labiolingual and buccolingual direction, then in the mesiodistal direction.

The results of the study are presented in the tables and illustrations that follow. The tables give the number of teeth examined and the percentages of variations and conditions found. The illustrations show the teeth enlarged to almost twice normal size. They are so arranged that the upper portion of each shows the usual labial or buccal views as seen in roentgenograms of teeth *in situ*. The lower portion shows the mesiodistal view of the same teeth. Anomalies were not used. Some of the teeth roentgenographed were previously filled with guttapercha and eucapercha. Others were not filled.

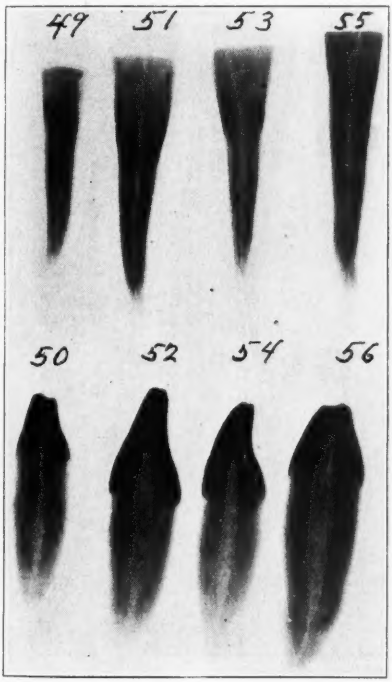

Fig. 7.—Lower central incisors showing denticles.

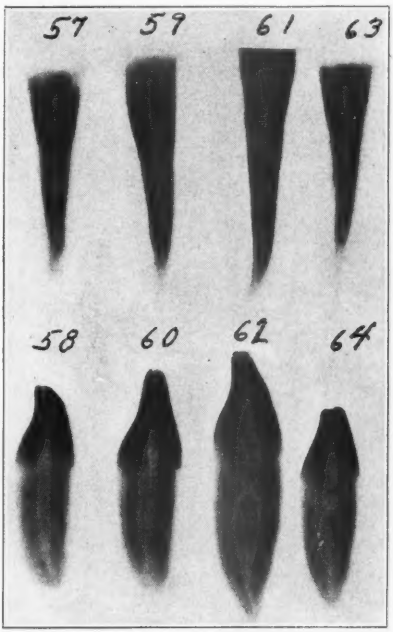

Fig. 8.—Lower central incisors showing wide canals with obstructions.

It is hoped that this experiment may be of some assistance in diagnosing conditions found in teeth *in situ*. It is believed that the number of teeth examined (1,394) is sufficient to justify generali-

zations from data presented in the tables and illustrations. It is true that the canals in the teeth *in situ* may have some decided twists that cannot be discovered in roentgenograms that are taken in the usual labiolingual and buccolingual directions. Still, it is hoped that the percentages given in the first five tables, and the measurements given in Table 6 will assist dentists in reaching conclusions in their diagnosis of practical cases.

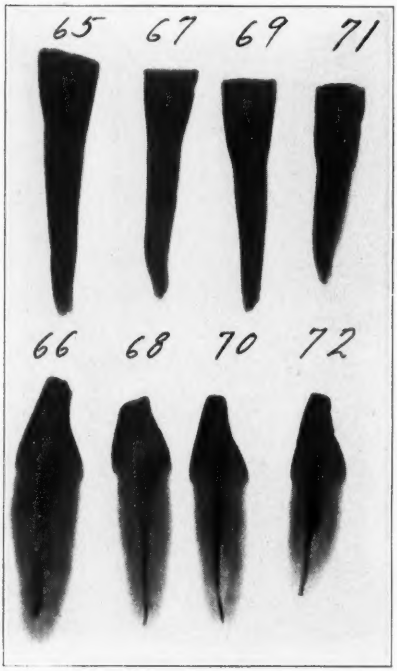

Fig. 9.—Lower central incisors with irregular canals.

Hess[5] says:

The literature on the anatomy of the root canals of the human teeth which appeared previous to 1891 contains no references to the special anatomy of the root canals, most of the authors being satisfied to describe the exterior forms of the roots. The most detailed description of the root canals (i. e., their number and course) was given by Carabelli in 1844, who reproduced a few illustrations of pulp canals. Not only is there nothing new in later publications, but Carabelli's records seem to have been forgotten. . . .

In the year 1903, Miller published his work on conservative dentistry (sic). He insisted on the importance of an exact knowledge of the anatomy of the root canals, and showed by diagrams the different varieties of form and course of the canals.

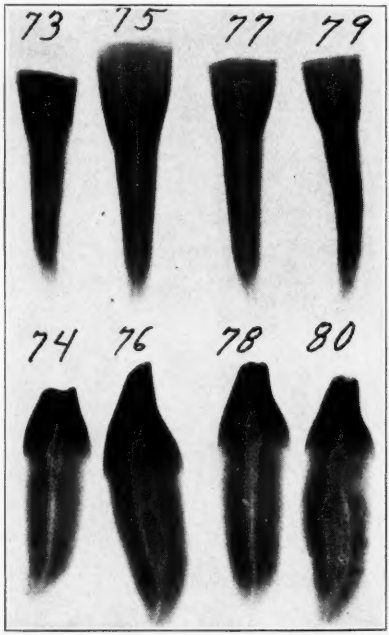

Fig. 10.—Lower lateral incisors showing narrow and wide canals.

Diamond[6] says:

The pulp canal is a central channel running vertically through the body of the root,

5. Hess, Walter: Anatomy of Root Canals of Permanent Dentition, trans. revised by William Henry Dolamore, London: John Bale, Sons, & Danielsson, Limited, 1925.

6. Diamond, M.: Dental Anatomy, New York: The Macmillan Company, 1929.

and communicating on the one hand with the pulp chamber, and on the other, through the apical foramen, with the general nutrient systems. It also contains pulp tissues.

The pulp cavities are formed gradually through the deposition of dentin inwardly from the dento-enamel junction of the crown and from the dento-cemental junction of the root.

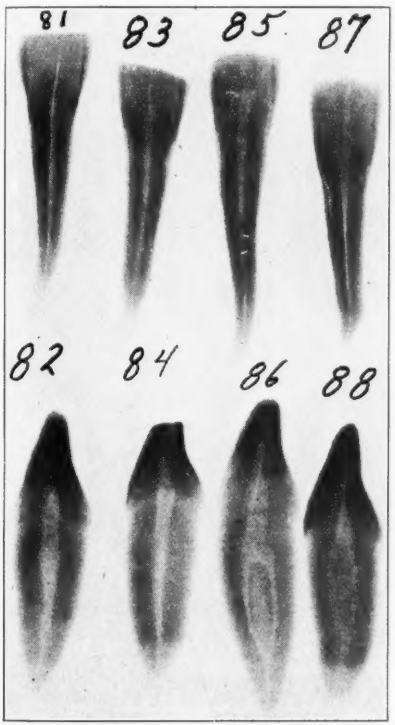

Fig. 11.—Lower lateral incisors with normal canals.

The first teeth to be considered are the incisors. Figure 1 shows four upper central incisors with the usual conical canals. These four canals are all about the same size except for length. Teeth *4* and *8* have curved roots. The canals of these teeth take the general outline and shape of their respective roots. These curves do not show in the labial views, *3* and *7*.

Figure 2 is also of upper central incisors. These four teeth have been filled with guttapercha. The fillings are complete, and therefore show the canals far better than in the unfilled teeth in Figure 1.

Black[2] says:

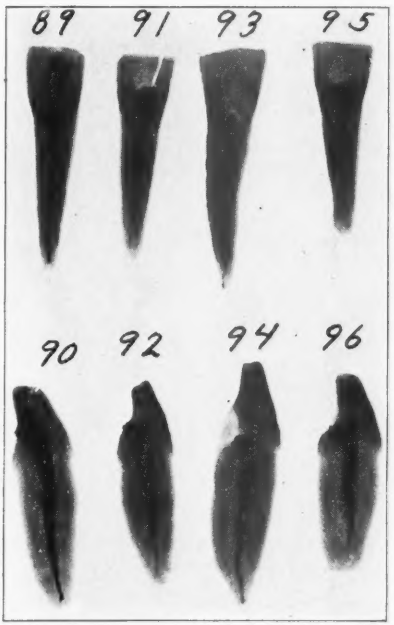

Fig. 12.—Lower lateral incisors showing normal canals.

The. . . root canals of the upper central and lateral incisors are so similar, the description of one will do for all. . . . In the upper central and lateral incisors there is no distinct division of the pulp cavity into the pulp chamber and root canal; but there is one straight canal, from the interior of the body of the crown to the apex of the root. . . . In young teeth, this has very distinctly the form of the surface of the tooth and root, except that it is much more slender. The largest diameter of the cavity is about

level with the gingival line on the labial surface. . . .

From the level of the gingival line toward the apex of the root it tapers very gradually and regularly to a narrow canal. Just within the apex of the root, almost at the end, there is usually a sudden contraction of the diameter of the canal, lessening it from one-third to one-half.

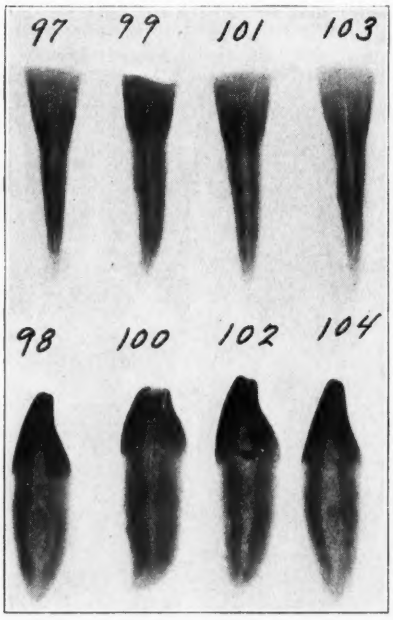

Fig. 13.—Lower lateral incisors showing regular and irregular canals.

Black[2] says further:

In incisors just taking their place in the arch, I have found the diameter of the canal at the gingival line to be from one-fourth to one-third the diameter of the neck of the tooth. In early adult age, the canal may be said to average about a fourth the diameter of the neck of the tooth, ranging down as age advances to one-fifth, or sixth or even one-tenth. In the lateral incisor, the chamber and canal are a little smaller than in the central, but larger in proportion to the size of the tooth.

Broomell,[7] Dewey,[8] Mummery,[9] Tomes[10] and Turner[11] all write in a similar vein.

In the study here reported, the canals of the upper incisors were found to be

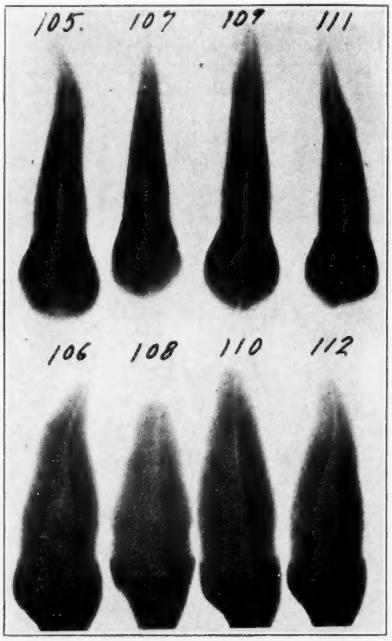

Fig. 14.—Upper cuspids showing usual canals.

7. Broomell, I. N.: Anatomy and Histology of Mouth and Teeth, Ed. 4, Philadelphia: P. Blakiston's Son & Company, 1913.

8. Dewey, Martin: Dental Anatomy, St. Louis: C. V. Mosby Company, 1916.

9. Mummery, J. H.: Microscopic and General Anatomy of Teeth Human and Comparative, Ed. 2, London: Humphrey Milford, Oxford University Press, 1924.

10. Tomes, C. S.: Manual of Dental Anatomy, Human and Comparative, Ed. 8, New York: The Macmillan Company, 1923.

11. Turner, C. R.: Text Book of Operative Dentistry by Various Authors, Ed. 2, edited by C. N. Johnson, Philadelphia: P. Blakiston's Son & Company, 1911.

of simple form. Three hundred sixty-eight were examined.

The upper lateral incisors are the next to be considered. Figure 3 shows four upper lateral incisors with no apparent irregularities. Tooth *18* shows a deposition of secondary dentin on the lingual wall in the gingival third of the canal. This is probably due to the irritation from the foil filling. The canals are quite conical in shape. Tooth *23-24* has a double curved root.

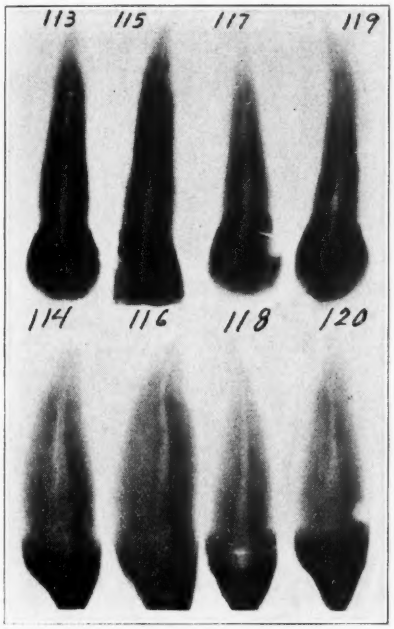

Fig. 15.—Upper cuspids showing conical canals.

Figure 4 is also of four upper lateral incisors. Teeth *27-28* and *31-32* are quite regular and conical in shape. Tooth *25-26* shows a pulp stone or denticle near the apex. The labial view of this tooth (*25*) shows a foramen in the region of the denticle. In tooth *29* (the labial view), the canal appears to be conical. The mesial view (*30*) shows this same tooth to have an irregularly shaped canal. In the middle third, this canal widens toward the apex and narrows toward the gingival line.

Figure 5 is of four upper lateral incisors whose canals have been filled. The canals are all conical in shape. The apex of *33* is turned sharply toward the distal aspect. Tooth *35-36* has a prominent denticle in the gingival third. This shows slightly in the labial view (*35*). In the mesial view (*36*), it is very distinct.

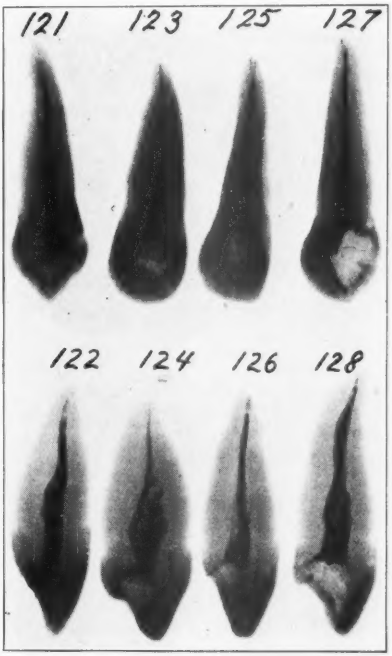

Fig. 16.—Upper cuspids showing irregular canals.

Figure 6 is also of four upper lateral incisors with root canal fillings. The labial views show them all to be quite conical. The mesial views show them to

be flat and irregular. The lingual wall of the canal of tooth *42* is quite irregular. *44* has a very irregular wall on the labial aspect. It also has a prominent bulge on the lingual wall in the gingival third. The canal in tooth *46* is rather flat. Tooth *47-48* has a large canal. This tooth probably was extracted from the mouth of a very young person.

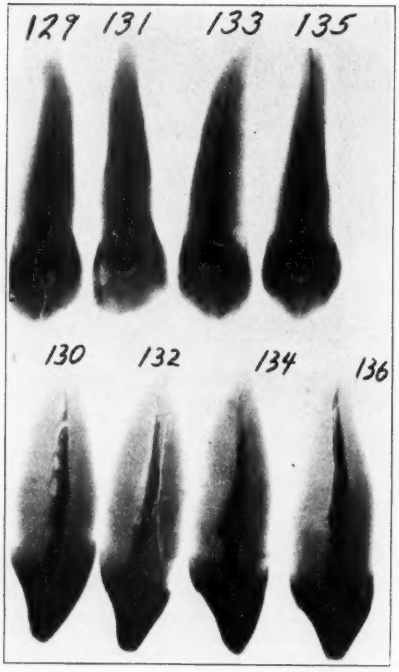

Fig. 17.—Upper cuspids showing irregular canals and denticles.

Black,[2] Broomell,[7] Diamond,[6] Dewey[8] and Mummery[9] write of the lower incisors substantially as Turner[11] does:

> This cavity follows the general form of the exterior of the tooth. . . . The latter (canal) is flattened and narrow in its beginning at the cervix and occasionally divides into two canals which usually unite near the apex and terminate in a single foramen. In most instances, however, it exists as a small, slightly flattened canal.

In addition, Hess[5] informs us:

> Besides this partition of the canal another type of division is found, in which the root-canal divides only in its last third, fork-like, there being two apical foramina. . . . Among the 136 lower incisors investigated, fifty, i. e., 37.6 per cent, showed bifurcation of the root-canal, the remainder had only one canal.

The results of the present investiga-

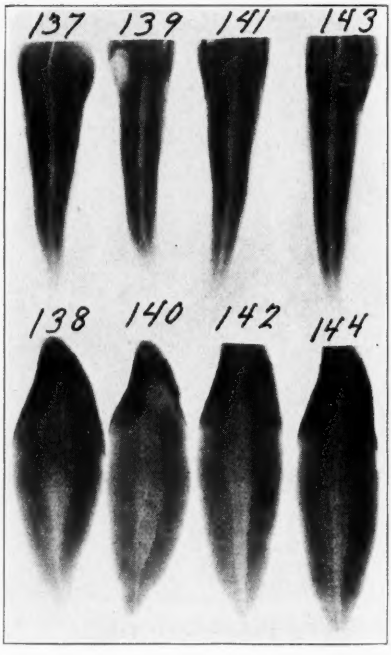

Fig. 18.—Lower cuspids showing conical canals and denticles.

tion corroborate those of Hess. I examined 103 lower incisors.

The lower central incisors are the third group to be considered. Figure 7 is of four lower central incisors. Lower incisors usually have wide and flat canals. They may have obstructions or denticles which cause the teeth to have divided

canals. Tooth *49-50* shows a canal that is quite obliterated except for the apical half. Tooth *51* shows a denticle in the middle half of the root. This denticle is more prominent in the mesial view (*52*).

In Figure 8, all the teeth (central incisors) show wide canals in the labiolingual direction, while the mesiodistal views reveal that these same canals are

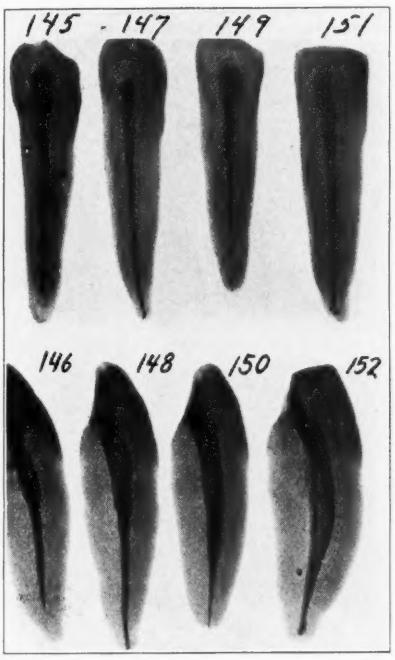

Fig. 19.—Lower cuspids showing regular conical canals.

quite narrow. The denticles in *61-62* and *63-64* are quite prominent in the mesial views (*62* and *64*).

Figure 9 shows four filled lower central incisors. Tooth *67-68* has a true conical canal; the others are quite flat. Teeth *66* and *70* have canals that are quite wide in the apical third.

Fourth in the group of incisors is the lower lateral. Figure 10 shows four lower lateral incisors. Teeth *74* and *78* have denticles in the pulp chambers. They also have true conical canals. The other two teeth have flat canals which show large denticles, or probably complete separation of the canals in the middle third.

Figure 11 also shows four lower lat-

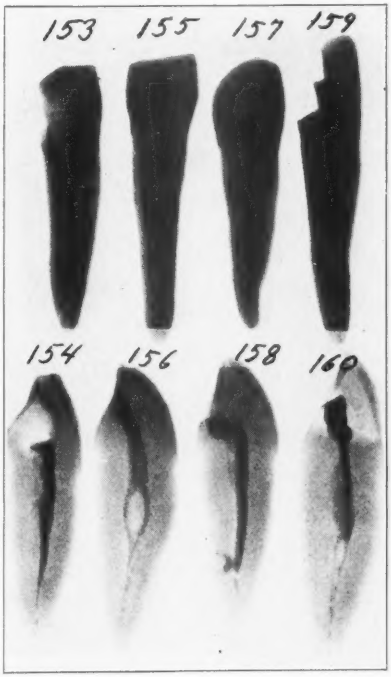

Fig. 20.—Lower cuspids showing irregular canals and denticles.

eral incisors. Tooth *85* reveals a dense, large obstruction. The mesial view (*86*) proves this obstruction to be a division in the canal. Tooth *87* shows a very narrow canal, although the mesial view (*88*) reveals a very wide canal.

Figure 12 shows four filled lower lateral incisors. The first three teeth

(*89* to *94*) show conical canals. Tooth *95* to *96* shows a flat canal with a denticle in the apical third, the presence of the denticle causing the formation of two canals.

In Figure 13, there are four more lower lateral incisors. Tooth *97-98* shows a bifurcation in the middle half of the canal. Tooth *100* shows two foramina at the apex and denticles in the pulp chamber. Tooth *101-102* has a true conical canal. To digress from the subject of canals and still consider a condition closely allied, attention is called to the crowns of the first three teeth (*97* to *102*). They are all quite worn, and yet their pulp chambers have not receded. Therefore, the bifurcation in *97-98* and the narrow conical shapes of *99-100* and *101-102* are not necessarily due to age and wear. The denticle in *103-104* is not dense.

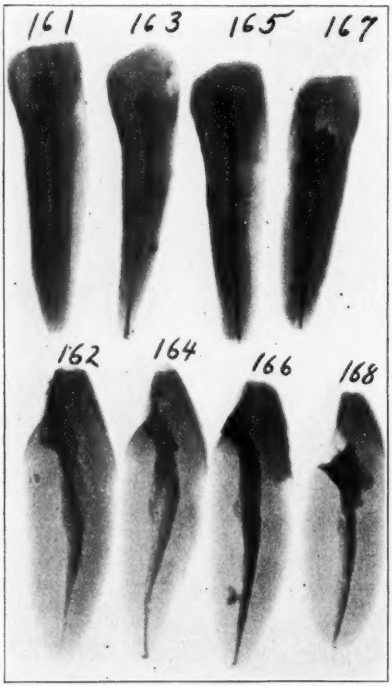

Fig. 21.—Lower cuspids showing regular canals.

Black,[2] Broomell,[7] Hess,[5] Turner[11] and Mummery[9] write of the upper cuspids substantially as Dewey writes:

> The pulp cavity of the canine, as a rule, is a straight canal, following the outline of the root, and is much larger than it is in any of the other single rooted teeth.

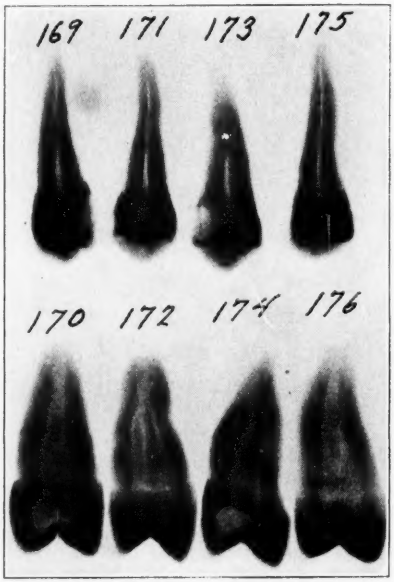

Fig. 22.—Upper first bicuspids showing single roots having one or two irregular canals.

In the present investigations, there were found many irregularities, as Table 3 and Figures 16-17 show. The number of upper cuspids examined was 197.

Figure 14 shows four upper cuspids. All four teeth have canals that are conical in the apical half; while, in the gingival half, these canals are wide and flat.

Tooth *112* shows a denticle in the gingival third.

Figure 15 shows four more upper cuspids. These teeth have canals that are quite conical. Those in the gingival third of teeth *114, 116* and *120* are somewhat flat.

In Figure 16, there are four upper cuspids. Teeth *121* and *127* show conical canals. Their mesial views in *122* and *128* show these canals to be quite irregular. Tooth *123-124* is odd. The apical half of the root has a fine narrow canal. The gingival half of this tooth has an enormous canal. Still, this canal is quite the shape of the bulky tooth. Tooth *125-126* has a simple true conical canal.

In Figure 17, there are four upper cuspids with irregularities. In the labial views, the canals appear quite regular. In tooth *130,* there are many denticles along the lingual wall of the canal. The lingual walls of the canals in teeth *132* and *136* show either (1) a narrowing of the canals, so that the filling material could not enter these spaces, or (2) a recent calcification, the calcified areas not having had time to become so dense as the rest of their respective teeth. In these two teeth, there are denticles on the lingual walls in the gingival third. Tooth *134* shows a bulging of the canal toward the lingual aspect in the gingival third.

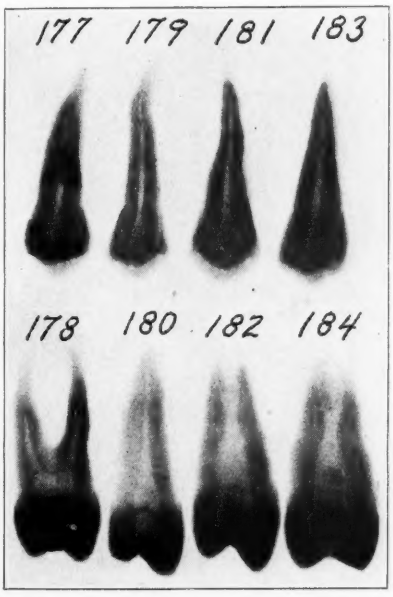

Fig. 23.—Upper first bicuspids showing one and two roots.

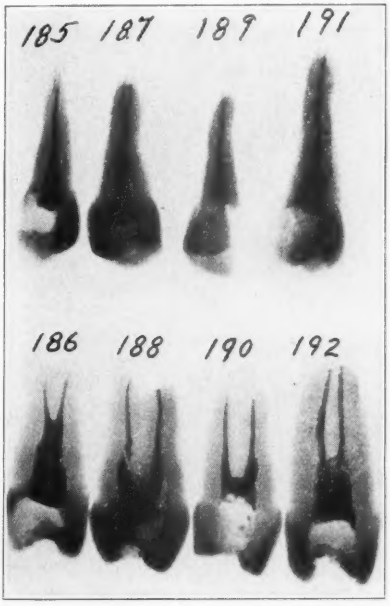

Fig. 24.—Upper first bicuspids showing single roots with two canals.

Second in the group of cuspids are the lower.

Hess[5] says:

> In contradiction to the upper canine, which have a single, undivided canal, the lower

have similar anatomical differentiations of the root-canals to those found in the lower incisors. The shape of the root-canal conforms to that of the root, and has a labio-lingual diameter longer than the mesio-distal. Early in life the root-canals of the teeth are large, of a simple structure, without apical ramifications. . . . In later years, bifurcations of the root-canals occur, through the formation of dentin bridges from the walls of the root-canals in the mesio-distal direction. These may lead to the formation of septae and then divide the canals into

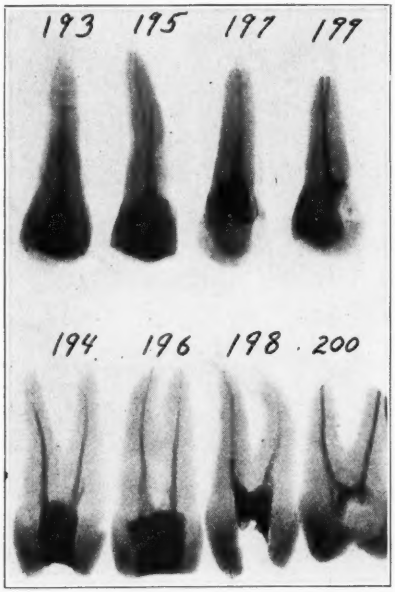

Fig. 25.—Upper first bicuspids with varying degrees of root bifurcation.

labial and lingual ones. . . . In addition to these divided canals others may be found, which show a simple, undivided canal at the beginning but terminate as a bifurcation in the lower third of the root. . . .

Among the 126 lower canines investigated, fifty-four showed bifurcations, i. e., 43 per cent. . . .

Black,[2] Broomell,[7] Dewey,[8] Mummery[9] and Turner[11] substantiate what Hess writes. In the present investigation, many denticles and incipient bridges of dentin were found. The number of lower cuspids examined were 106.

The teeth in Figure 18 are lower cuspids. Their canals are quite regular and similar. Tooth *139-140* has two denticles, one in the middle third, the other in the gingival third.

Figure 19 shows four lower cuspids with very regular canals. Teeth *145-146*

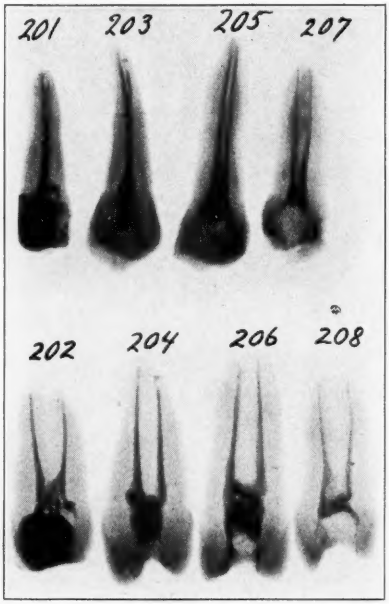

Fig. 26.—Upper first bicuspids showing single roots with two canals.

and *147-148* have canals that are very conical in the apical half. The other two teeth have flat canals. These canals taper to a roundness near the apex.

Figure 20 shows four lower cuspids with irregularities. Teeth *154* and *158* have a narrowing of the canals along the lingual walls in the gingival third. Tooth *156* has a large denticle in the middle third which almost obstructs the

entire canal. Tooth *160* has a narrowing of the canal along the lingual wall in the gingival half. The apical half of this canal has several denticles which are visible in tooth *159*.

Figure 21 is another example of four lower cuspids with very regular and tapering canals.

The upper bicuspids have canals with many varying conditions.

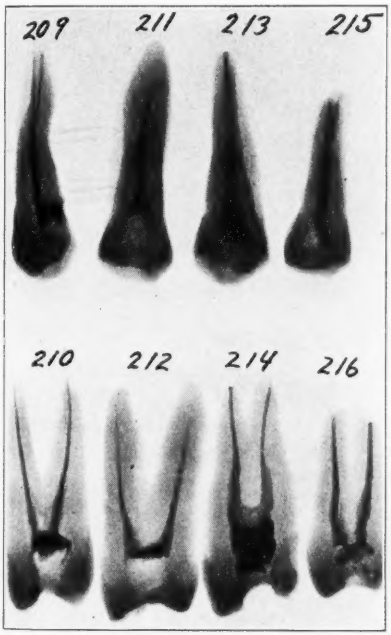

Fig. 27.—Upper first bicuspids showing varying degrees of root bifurcation.

Black[2] says:

The root canals in upper first bicuspids that have two roots pass from the pulp chamber through the center of each root to its apex. . . . Each canal begins in a funnel-shaped opening leading into a narrow round canal, which tapers gradually to the apical foramen. Many of the upper first bicuspids have only one root; but they generally have two root canals almost exactly similar to those with two roots. Occasionally, however, these come together and end in one apical foramen, or there may be a communication between the two canals in some part of their course. More rarely, the upper first bicuspid has one broad (from buccal to lingual), flat canal passing through the whole length of its single root. Sometimes this is divided near the apex.

Port[12] says that, in extracted teeth, it is very difficult to distinguish an upper second bicuspid from an upper first bicuspid.

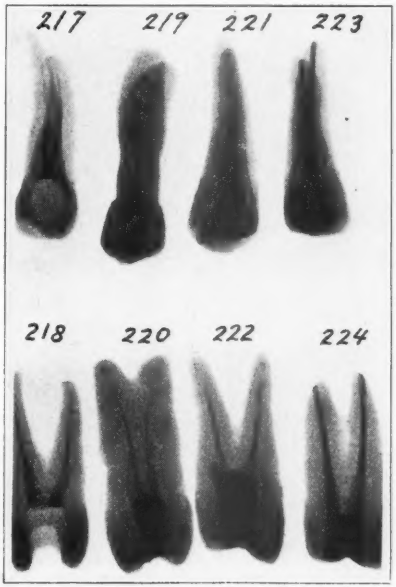

Fig. 28.—Upper first bicuspids showing varying degrees of root length and root bifurcation.

Mühlreiter[1] (8) states that the difference between the first and second upper bicuspids is not great. If one has but one of these teeth before him, it is not

12. Port, G.: Die Wurzelkanäle der unteren Molaren und der oberen zweiten Prämolaren, Oesterreich.-Ungar. Vierteljarhsschr. f. Zahnheilk., 1905.

always possible to be positive in the differentiation. If one has both teeth from the same mouth, it is not quite so difficult to differentiate.

Broomell,[7] Dewey,[8] Diamond,[6] Hess[5] and Turner[11] all substantiate what Black, Port and Mühlreiter write. Turner adds that the buccal cusp of the upper first bicuspid is longer than the lingual cusp. Because of the great variations that have been found in the bicuspids, the present study contains more views of these teeth than of any others. The number of upper first bicuspids examined was 130.

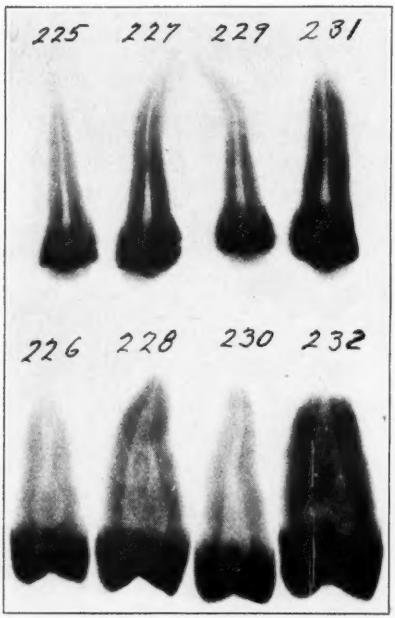

Fig. 29.—Upper second bicuspids, single rooted showing denticles.

Figure 22 shows four upper bicuspids each with a single root. Tooth *169-170* has a denticle in the middle third and two foramina at the apex. Tooth *171-172* has a large denticle or canal division in the middle third and another at the apex. These two denticles make the tooth appear to have two very irregular canals. Tooth *173-174* has two curving canals. Tooth *175-176,* like *169-170,* has a denticle in the middle.

Figure 23 shows four upper first bicuspids. Tooth *177-178* has two distinct roots. The lingual canal is large. The apical half of the buccal canal seems to be obliterated. Tooth *179-180* has but one simple canal, which follows the curvature of the root. Teeth *181* and *184* have wide canals which bifurcate in the apical third. Tooth *184* has a denticle in the gingival third, which is slightly visible in *183.*

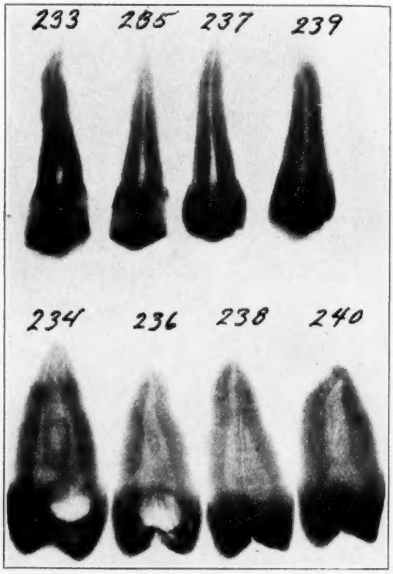

Fig. 30.—Upper second bicuspids, single rooted with one or two canals.

Figure 24 shows four single-rooted upper first bicuspids with varying degrees of canal bifurcation.

Figure 25 shows four two-rooted upper first bicuspids. The canals are all simple ones except the lingual canal in *194*. This canal has a lateral foramen which seems to be larger than the apical foramen.

Figure 26 shows four single-rooted upper first bicuspids. Each root has two almost straight canals.

Figure 27 shows four more bicuspids with varying types of root bifurcation. The canals are quite regular.

Figure 28 shows four more upper first bicuspids with still more varying types of root bifurcation. Teeth *218* and *224* show the roots to be of irregular length.

The upper second bicuspids may have conditions that are very similar to those found in the upper first bicuspid.

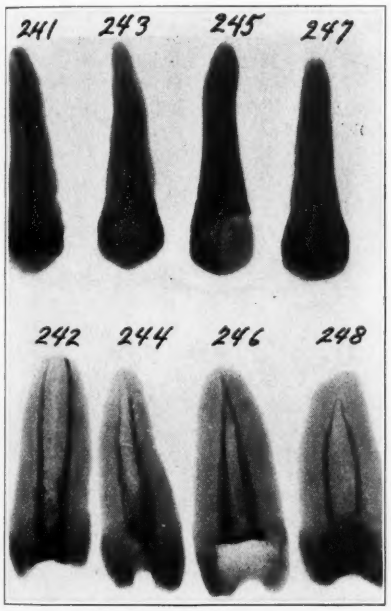

Fig. 31.—Upper second bicuspids, single rooted showing two canals.

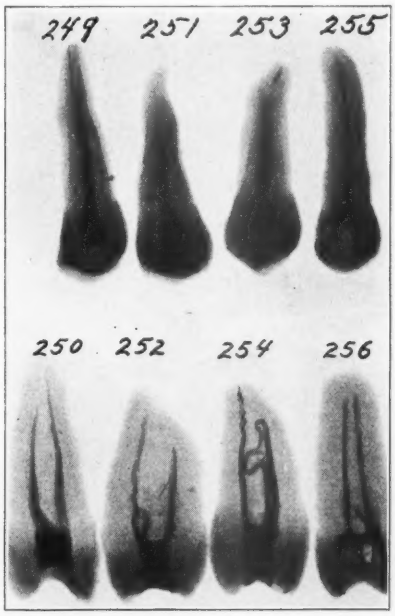

Fig. 32.—Upper second bicuspids, single rooted showing irregular canals.

Hess[5] says:

> The second upper premolar has in a great majority of cases a simple root; on the other hand here and there slight divisions are indicated at the apex, but a distinct division, as in the first premolars, is rare.
>
> The root-canals show great variability in the form and number. In a divided root there are always two canals; but in a great number of single-rooted, second premolars two separate canals occur, which often divide again at the apex and terminate in a fork. . . .

My investigations extend over 246 upper second premolars. Of these, 56 per cent possessed one canal, 42 per cent two canals, and 2 per cent three canals.

Black,[2] Tomes[10] and Turner[11] write substantially the same as does Hess about this tooth having a canal formation similar to that of the upper first bicuspid.

In examining 128 upper second bi-

cuspids, I corroborated the findings of Hess.

Figure 29 shows four upper second bicuspids. The canals are quite typical, being wide buccolingually and narrow mesiodistally. Teeth *227-228* and *231-232* have each, in the middle third of the root, a denticle or canal bifurcation, visible in the buccal views.

Figure 30 shows four types of canals in upper second bicuspids. Each tooth has a single root. Tooth *233-234* has two distinct parallel canals. Tooth *235-236* has a single canal with a decided bifurcation at the apex. This canal has a denticle in the middle third which is visible in the buccal view (*235*). In tooth *237-238,* the canal is wide and tapering. The buccal view (*237*) shows it to be narrow. Tooth *239-240* has a wide canal for most of its length. The buccal view (*239*) shows the foramen to be mesial at the apex.

Figure 31 exhibits four upper second bicuspids with two distinct canals in single-rooted teeth. Teeth *242* and *244* show their canals to be separated for their entire length; whereas, teeth *246* and *248* show that the canals join near the apex.

Figure 32 shows four single-rooted upper second bicuspids. Each root has two canals and each root has but one apical foramen. Teeth *250* and *256* have almost parallel canals. The pulp chambers in teeth *252, 254* and *256* were not

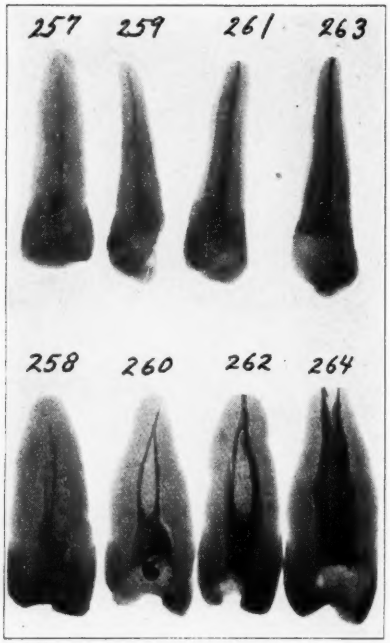

Fig. 33.—Upper second bicuspids, single rooted, denticles and irregular canals.

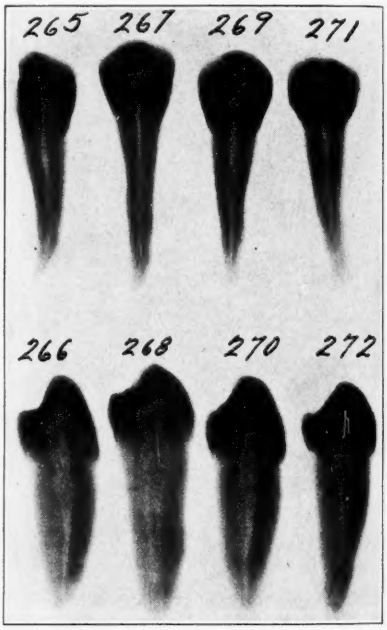

Fig. 34.—Lower first bicuspids showing conical canals.

opened. Only the horns of these pulp chambers were opened. The canals in tooth *252* have a wide separation in the middle third of the root. The canals in *254* are separated in the gingival third and again near the apical third.

Figure 33 shows four upper second bicuspids with varying types of canals. Tooth *258* has a flat, narrow canal.

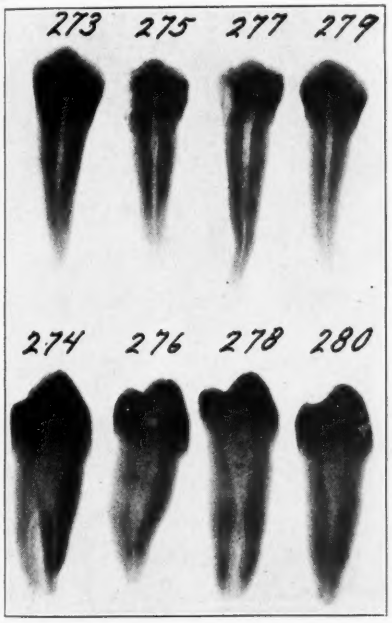

Fig. 35.—Lower first bicuspids showing irregular and bifurcated canals.

Tooth *260* has two distinct canals which join in the apical third and then seem to cross to their respective foramina. In tooth *262,* the tooth structure which separates the canals seems lumpy, as though it consists of pulp stones or denticles. Tooth *264* has a wide canal which bifurcates in the apical third.

The lower first bicuspid is the third division to be considered in the bicuspid group.

Turner[11] says of the lower first bicuspid:

> As in all single rooted teeth there is no sharp division between the pulp chamber and canal. . . . At the level of the gingival margin the cavity is oval in cross-section whence it continues diminishing in buccolingual diameter to the apical foramen. It is usually small and threadlike in the apical third of the root.

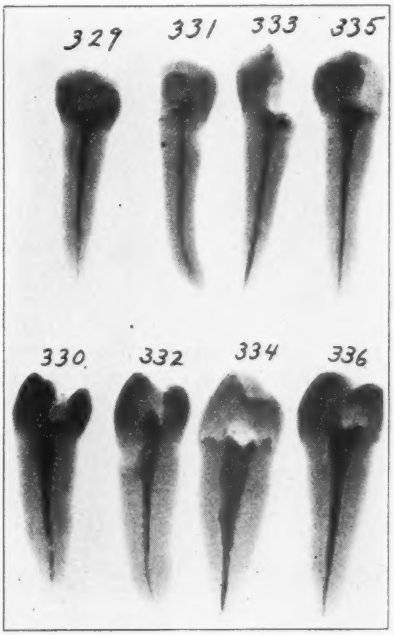

Fig. 36.—Lower first bicuspids showing bifurcated and conical canals.

Black,[2] Dewey,[8] Mummery[9] and Tomes[13] substantiate Turner's statement. Hess[5] states that in "2.3 per cent there is a suspicion of a division of the

13. Tomes, C. S.: Manual of Dental Anatomy Human and Comparative, Ed. 2, London: J. & A. Churchill, 1882.

root-canals." Broomell[7] writes: "In some instances the canal divides near the center of the root, and is continuous as two canals, ending in distinct foramina, or, after separating, they may again unite, and end in a single foramen."

Hess found two lower first bicuspids with bifurcated canals. I found seven, or 4.48 per cent, in the 156 teeth that I examined.

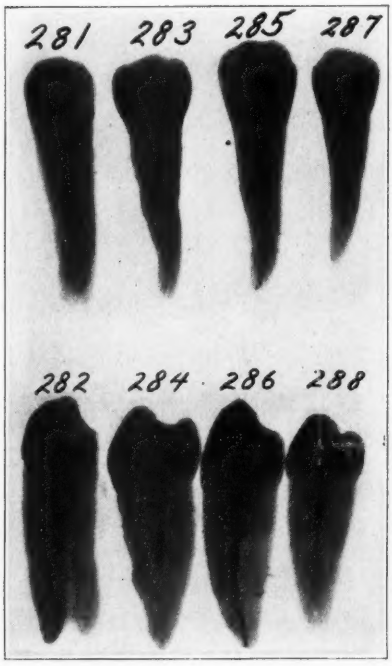

Fig. 37.—Lower first bicuspids showing conical canals.

Figure 34 shows four lower first bicuspids. All the canals are simple except in tooth *268*. This canal has a separation in the middle third and again at the apex.

Figure 35 shows four more lower first bicuspids. Tooth *273-274* has a wide canal until the root bifurcates in the middle third. Teeth *276* and *280* have simple canals which show two foramina at each apex. Tooth *277* seems to have a tapering canal with a dense object in the middle third. The mesial view (*278*) shows a denticle in the gingival third, a narrowing of the canal in the middle third and a widening toward the apex.

Figure 36 shows four lower first bicuspids. Tooth *281-282* shows another wide canal which divides as the root bifurcates. The other three teeth have simple conical canals.

Fig. 38.—Lower first bicuspids showing bifurcated and conical canals.

Figure 37 shows four lower first bicuspids with simple conical canals.

Figure 38 shows four lower first bicuspids. Teeth *297-298* and *299-300*

have simple conical canals. Teeth *301-302* and *303-304* have wide canals until they bifurcate. The canal in *302* bifurcates in the apical third, the canal in *304*, at the apex.

The pulp canals of the lower second bicuspid are usually of simple conical form.

Turner[11] says of the lower second bicuspid: "The canal is oval or circular in cross-section at the cervix, from whence it tapers gradually to the apical foramen."

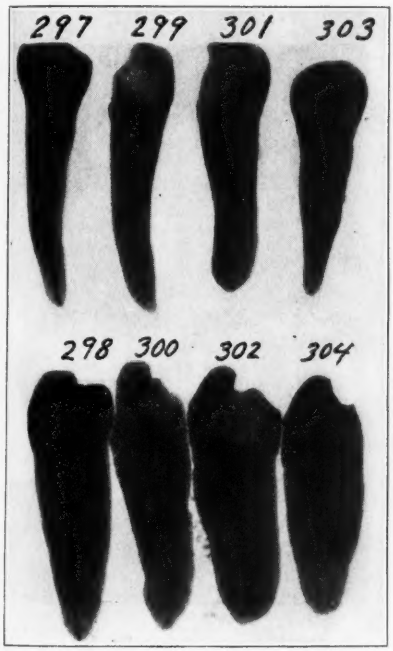

Fig. 39.—Lower second bicuspids showing conical canals.

Dewey[8] and Mummery[9] write of this tooth as did Turner. Hess[5] has more to add:

> The second lower premolars show in general similar conditions to the first lower premolar. The root-canals are mostly of simple form, slightly larger than in the first lower premolars. Besides the simple cylindrical canals, tapering toward the apex, a partition of the root-canal is also found. . . . According to my preparations, this division shows itself only in the lower half of the root, and appears in the form of a fork, of which one canal may be divided again, so that then three canals exist. In general, the division of the canal takes place only in the apical region of the root, when it terminates in several fine branches. . . .

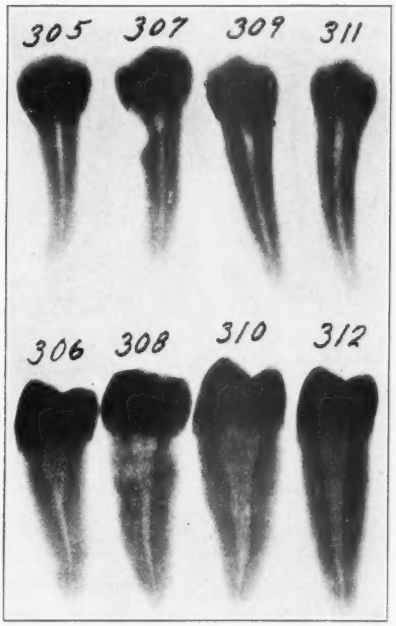

Fig. 40.—Lower second bicuspids showing irregular canals.

> Among the sixty-five lower second premolars investigated only five, i. e., 7.5 per cent, were found to have a division of the canal; whilst the apical ramifications were found in 49 per cent, and the narrow canals in 20 per cent.

I found no bifurcated canals in the 206 lower second bicuspids which I examined.

Figure 39 shows four lower second bicuspids. All the canals are of a simple tapering type. In tooth *310,* the canal does not taper as gradually as in the others. In tooth *307,* there is a thickening of the walls in the gingival third due to the irritation from caries.

Figure 40 shows four lower second bicuspids with varying types of canals. The buccal views appear to be similar.

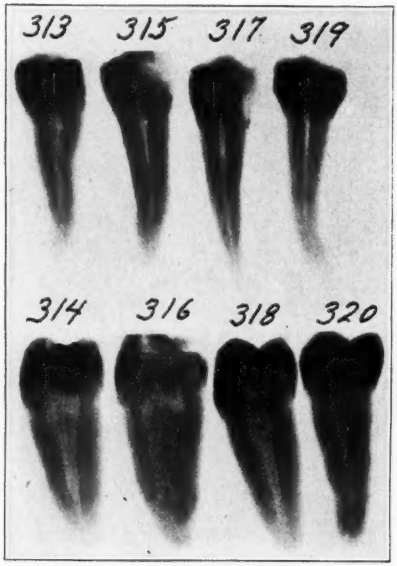

Fig. 41.—Lower second bicuspids showing conical canals.

Tooth *314* has a simple wide canal. Tooth *316* has a wide canal with multiple foramina in the apical third. There is also a denticle in the apical third. Tooth *318* has a wide canal with two foramina at the apex. In Tooth *319-320,* there is a canal which appears to be wider in the buccal view than in the mesial.

Figure 41 shows four lower second bicuspids with simple tapering canals. In Tooth *321-322,* there is a denticle in the apical third which is visible in both views.

Figure 42 shows four more lower second bicuspids with simple conical, tapering canals. In teeth *330* and *334,* there are denticles in the middle third on the buccal walls of the canals.

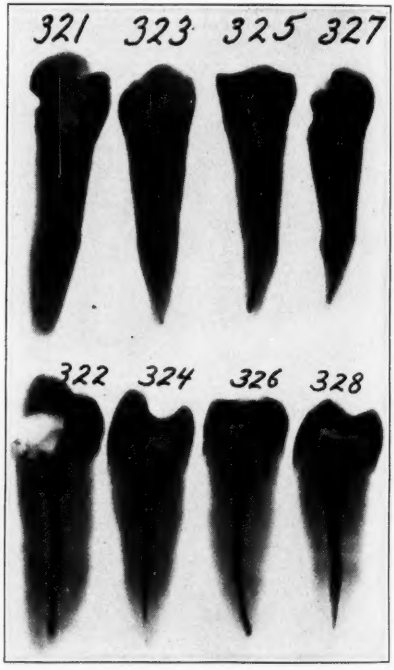

Fig. 42.—Lower second bicuspids showing conical canals.

CONCLUSIONS

1. There is not any kind of cone or a measurement of any cone that can be spoken of as being typical of the conical shape of the root canals of any of the human teeth.

2. In each type of human tooth, there are great variations in the shape, length and width of the canals.

TABLE 1.—CONDITIONS FOUND IN CANALS OF 368 EXTRACTED UPPER INCISORS BY MEANS OF LABIOLINGUAL AND MESIODISTAL ROENTGENOGRAMS.

Conditions Found	Central Incisors		Lateral Incisors	
	Number	Percentage	Number	Percentage
Number of teeth examined	244	.....	124	.....
Almost round, tapering	238	97.54	122	98.38
Slightly flat mesiodistally	6	2.46	.....	.....
Flat the entire length, tapering	.....	.....	2	1.61
Denticles in middle third visible from labial aspect	5	2.05	.....	.....
Denticles in gingival third visible from labial aspect	3	1.23	1	0.81
Denticles in gingival third and middle third visible from labial aspect	2	0.82	.....	.....
Denticles in apical third visible from labial aspect	4	1.64	2	1.61
Denticles in apical third not visible from labial aspect	1	0.41	.....	.....
Multiple foramina at apex visible in roentgenogram	.....	.....	1	0.81

TABLE 2.—CONDITIONS FOUND IN CANALS OF 103 EXTRACTED LOWER INCISORS BY MEANS OF LABIOLINGUAL AND MESIODISTAL ROENTGENOGRAMS

Conditions Found	Central Incisors		Lateral Incisors	
	Number	Percentage	Number	Percentage
Number of teeth examined	44	.....	59	.....
Quite round and tapering	14	31.82	28	47.46
Quite flat the entire length	18	40.91	20	33.89
Quite flat, apical third round	10	22.72	5	8.47
Quite flat, apical half round	2	4.54	6	10.17
Denticles in apical half not visible from labial aspect	.....	.....	4	6.78
Denticles in middle third not visible from labial aspect	8	18.18	13	22.03

3. The canals of one type of the human tooth differ greatly from the canals of another type of the human tooth.

4. Without the microscope, one cannot tell whether a denticle is true or false.

5. A bridge of dentin from one wall of the canal to the other may appear in a roentgenogram as a true denticle.

6. An obstruction in a canal may appear in the roentgenogram to be a denticle, when, in fact, it may be the formation of two canals.

7. The usual labiolingual or buccolingual roentgenogram of the teeth does not always present a true picture of the conditions that are present in the root canals.

TABLE 3.—CONDITIONS FOUND IN CANALS OF 303 EXTRACTED CUSPIDS BY MEANS OF LABIOLINGUAL AND MESIODISTAL ROENTGENOGRAMS

Conditions Found	Upper Cuspids		Lower Cuspids	
	Number	Percentage	Number	Percentage
Number of teeth examined	197	.....	106	.....
Quite round, tapering	108	54.82	17	16.04
Flat the entire length, tapering	3	1.52	14	13.20
Flat canals, apical third round, tapering	48	24.36	45	42.45
Flat canals, apical half round, tapering	36	18.26	30	28.30
Flat the entire length, apex constricted	2	1.01	.....	.....
Denticles in middle third visible from labial aspect	6	3.05	3	2.83
Denticles in gingival third visible from labial aspect	1	0.50	1	0.94
Denticles in middle third not visible from labial aspect	5	2.54	10	9.43
Denticles in gingival third not visible from labial aspect	1	0.50	1	0.94
Denticles in gingival and middle third not visible from labial aspect	5	2.54	1	0.94
Denticles in gingival half visible from labial aspect	5	2.54	.....	.....
Denticles the entire length	2	1.01	.....	.....
Denticles in apical third visible from labial aspect	.....	.....	1	0.94
Denticles in apical and middle third visible from labial aspect	1	0.50	4	3.77
Denticles in apical half not visible from labial aspect	.....	.....	4	3.77

TABLE 4.—CONDITIONS FOUND IN CANALS OF 258 EXTRACTED UPPER BICUSPIDS BY MEANS OF BUCCOLINGUAL AND MESIODISTAL ROENTGENOGRAMS

Conditions Found	First Bicuspid		Second Bicuspid	
	Number	Percentage	Number	Percentage
Number of teeth examined	130	.....	128	.....
Flat the entire length, tapering	.....	.....	11	8.59
Flat canals, apical half round, tapering	.....	.....	2	1.56
Two distinct roots	89	68.46	2	1.56
One root, two canals, joining at apex	21	16.15	2	1.56
One root, one canal, bifurcated at apex	9	6.92	1	0.78
One root, two distinct canals	9	6.92	16	12.50
One canal, flat buccolingually	2	1.54	93	72.66
Bifurcated in middle third	.....	.....	1	0.78
Multiple foramina visible in roentgenogram	.....	.....	4	3.12
Denticles in apical third visible from buccal aspect	.....	.....	1	0.78
Denticles in middle third not visible from buccal aspect	.....	.....	6	4.68
Denticles the entire length of canal not visible from buccal aspect	.....	.....	1	0.78

TABLE 5.—CONDITIONS FOUND IN CANALS OF 362 EXTRACTED LOWER BICUSPIDS BY MEANS OF BUCCOLINGUAL AND MESIODISTAL ROENTGENOGRAMS

Conditions Found	First Bicuspid		Second Bicuspid	
	Number	Percentage	Number	Percentage
Number of teeth examined	156	.....	206	.....
Quite round, tapering	127	81.41	185	90.69
Flat the entire length, tapering	.....	.....	10	4.91
Flat canals, apical third round, tapering	22	14.10	11	5.42
Bifurcation at apex	7	4.48	.....	.....
Constriction in middle third	1	0.64	.....	.....
Denticles in middle third visible from buccal aspect	2	1.28	.....	.....
Denticles in gingival third visible from buccal aspect	.....	.....	3	1.45
Denticles in apical third not visible from buccal aspect	.....	.....	1	0.48
Denticles in gingival third not visible from buccal aspect	.....	.....	2	0.97

TABLE 6.—RANGE IN MILLIMETERS OF CANAL SIZE IN GINGIVAL THIRD

	Teeth	Measurement			
		Mesiodistal		Labiolingual or Buccolingual	
		Minimum	Maximum	Minimum	Maximum
Upper	Central Incisor	0.50	2.33	0.50	1.75
	Lateral Incisor	0.25	1.00	0.66	1.50
	Cuspid	0.50	1.16	1.00	3.00
	First Bicuspid	0.20	0.50	0.20	0.50
	Second Bicuspid	0.33	0.60	1.00	3.50
Lower	Central Incisor	0.16	0.50	0.50	2.25
	Lateral Incisor	0.16	0.50	0.50	2.25
	Cuspid	0.25	0.66	1.00	2.00
	First Bicuspid	0.25	0.75	0.33	1.50
	Second Bicuspid	0.33	0.50	0.50	1.00

EXODONTIA OF PRACTICAL INTEREST TO THE GENERAL PRACTITIONER*

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IN THE effort to put into one brief paper a collection of concise thoughts on the theme of exodontia with practical bearing on everyday general practice, I shall aim to touch on some salient points of interest constantly apparent to the general practitioner.

Beginning with fundamentals, let me take up the factor of diagnosis. Strange to say, much as we all agree as to the significance of preliminary operative diagnosis, there is not yet so full a measure of reliance placed on proper diagnostic means at our command as is desirable. I refer especially here to preliminary roentgenographic examination. It is unwise for a general practitioner to proceed with the surgical technic of the removal of a tooth without a roentgenographic survey. There is so much that can be learned from the roentgen-ray examination that it is surprising to note how many general

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practitioners remove teeth without this invaluable aid. Since much of the difficulty which may arise is attributable to abnormality in the shape and direction of the root of a tooth, it would be manifestly logical to prepare oneself with the information which the roentgen rays impart. There are many who scoff at these findings. True, we may not always detect what is present, but this much is certain: When we see a curved root or a hypercementosed one, or a supernumerary or unerupted tooth follicle in association with the root of the tooth which we are to remove; or we see a cyst, or a metallic or other foreign body invisible to the naked eye or to the palpating finger, or a calcific deposit in a salivary gland; or we find the mandible is fractured in the region of the tooth to be removed, we may be absolutely firm in our corroborative diagnosis when we operate. We should not be taken by surprise. If roentgen-ray examination, both intra-oral and extra-oral, is made a routine procedure when there is swelling, we may eliminate the element of surprise which frequently confuses the general practitioner and forces him unwillingly and with much embarrassment, to seek the aid and advice of the consultant. The roentgenogram should guide the general practitioner to a decision as to whether the tooth or teeth under consideration should receive the attention of a specialist. On the decision he makes may rest the whole success or failure of his professional career. It is surely injudicious for the general practitioner, handling the nonacute case, to proceed to operate without full preparation for a proper handling of the conditions which may arise during the course of the operation. Of course, I do not wish you general practitioners to carry away the impression that you should delegate all your extraction cases to the office of the consultant, but unless one is prepared to complete an operation in a reasonable space of time, and with the expenditure of a minimum amount of nervous strain on the patient and himself, he is hurting his practice by not referring his cases to the consultant at the outset. The building of a general practice may be materially aided by the successful completion of an extraction operation; but it is well to remember that frequently the dissatisfaction of the patient is not an easy matter to dissipate even when the persuasive powers of the operator are of the highest order or the intelligence of the individual all that is to be desired. Pain and discomfort are not too easily explained, and sometimes it is the better part of valor to permit the consultant to handle the operation. The patient who is referred to a consultant for the completion of an unsuccessful attempt at the removal of a tooth is more often than not lost to the operator, regardless of the efforts of the specialist to have him return. There is a definite ill-will engendered, and only the broad-minded patient will return to the general practitioner for the restorative service originally planned. Therefore, I say again to the general practitioner, unless you are reasonably prepared to carry out the steps of operative technic in logical sequence with reasonable dispatch, it is injudicious to commence, and even though the operation is completed ultimately it is to be classed as an economic failure, causing loss of time to the operator and upsetting his office routine and schedule of appointments for the day.

The choice of an anesthetic is a matter of prime significance. It is well to give due heed to the nervous temperament of the patient and to avail oneself of a local or a general anesthetic for the extraction accordingly. It is well to bear in mind that even when we succeed in inhibiting

the sensory reaction of the patient, we are not always in a position to eliminate the full measure of psychic stress which an operation performed under local anesthesia will induce. For many patients, a general anesthetic is the judicious choice. When the services of a general anesthetist are available the general practitioner does not have to feel that because he is not a trained general anesthetist, his choice and suggestion to the patient must always be local anesthesia, unless there are acute suppurative conditions present.

The question frequently arises, under what conditions are we to remove a tooth which is the seat of an acute infection, associated with swelling and marked suppuration? If the tooth involved is loose and the roentgen-ray examination discloses no abnormality of root form, it is advisable to remove the tooth with or without incision for drainage in the intraoral soft tissues, as indicated. If the tooth affected is very firm, or if it may not be removed without fracture, it is wiser to establish drainage of the suppurating area and "nurse" the condition until subsiding acute symptoms permit the removal of the tooth without danger of spreading the infection. When a tooth which is the seat of an acute swelling fractures during the initial attempt at delivery, it is advisable to desist and complete the operation when the acute condition has subsided. To enter such an acutely infected bone area in order to remove deep fractured root ends may well break down the barriers, with possible resultant osteomyelitis. Gentle handling of acutely infected tissues is essential to uneventful recovery. Undue trauma must be avoided.

When there is external pointing, the dentist would do well to call the patient's attention to the possibility of an incision's having to be made from the outside regardless of the removal of the causative factor, the tooth or root. Frequently, the patient will not appreciate the efforts of the operator to avoid the necessity for external drainage and will blame him for not eliminating the infection when the tooth was removed. In many cases, when there is external pointing, I make the incision first, or at the time of the tooth removal, in order not to give the patient the impression that anything done at the operation for the tooth's removal was responsible for the need for extra-oral drainage.

One should proceed cautiously in removing mandibular third molars which are the seat of an acute pericoronitis or which give definite clinical evidence of Vincent's disease. Removal of such teeth in the presence of an active Vincent's infection may cause serious local and systemic exacerbation. Localized symptoms of trismus, difficulty in swallowing and a generalized edematous condition surrounding a pathologically erupting mandibular third molar require careful consideration. I irrigate the area and the throat well with hot sodium perborate, make a topical application of a 5 per cent solution of arsphenamine in glucose and put the patient on alkaline liquids and citrous fruit juices, and soft diet, with free elimination. I have the patient wash the area with sodium perborate frequently at home, and cold compresses are applied externally at ten-minute intervals for ten-minute periods. When the acute symptoms have subsided, the tooth may be removed with safety.

The elevation of the mucoperiosteum from the bone overlying a tooth root seems to be the wise procedure preliminary to the adjustment of the surgical agent for the removal of the tooth. The mucoperiosteum may be elevated when the attachment of the soft tissue investment is so firm that it may tear during the

tooth removal, with exposure of the adjacent bone and denuding of the contiguous teeth. The elevation of the mucoperiosteum may be made either with or without preliminary incision of the tissue, this depending on the requirements of the case in hand. When it is expected that a considerable operation on bone will be necessary, a generous reflection of the mucoperiosteal tissues should be made, facilitated by incisions which permit a free dissection from the bone. A proper exposure of the bone area to be operated on is a prime essential to conservative surgery. Unless this is made, one is very apt to cause injury by lacerating the soft tissue boundaries of the surgical area. It is not necessary to work in the dark. In the desire to be conservative, one is prone not only to do injury to the soft tissue boundaries, but also to overlook loosened particles of process which may adhere to the soft tissue around the alveolus and remain later to delay healthy regeneration. The formation of proliferative granulations in the alveoli, usually with attendant suppuration, is directly due to the presence of these loosened alveolar fragments, which would be removed at the time of operation if there were a free exposure by soft tissue elevation or dissection. Perhaps in the vast majority of tooth removals, the freeing of the tooth by primary forceps will deliver the tooth without much trouble. But this much is certain: If there is an elevation of the mucoperiosteum preliminary to forceps beak adjustment, there will most certainly be no undue laceration, while the failure to so detach the soft tissue, especially on the buccal or labial aspect, might frequently do injury to the investment.

Forceps and levers constitute the chief instruments for the removal of teeth and roots. When there is sufficient tooth structure available for proper beak adjustment, forceps make ideal instruments. When the coronal portion fractures away, or when the case presents only part of a root, reliance is placed on the lever. When the access to the root is not direct, we resort to the preparation of a bony access to the root by direct chisel force, with or without mallet aid, or by the use of an engine driven drill. I have abandoned the use of chisels and place complete reliance on the engine driven drill. It is not my aim to convert those operators who are satisfied with their technic. If one feels that he obtains results with chisels and mallets, they should be his choice until he feels that he desires some other agent in the interest of improved service. I looked for a substitute for hand pressure, which required a great deal of force and the expenditure of considerable energy and for a procedure that would do away with the need for applying a mallet to the hand chisel and subjecting the patient's jaws to blows, which many felt were uncomfortable, if nothing else. Dr. Ottolengui, in the October *Dental Items of Interest* condemns the chisel and mallet in no uncertain words. Speaking of root amputation, he says, with reference to the chisel and mallet, "Have that done to yourself, doctor, and you wouldn't do it to a patient." I also feel that the pounding of a mallet and chisel against the jaw cannot be pleasant. I have had it done to myself, and, oddly enough, the sensation lingers in my memory. Looking around for a substitute, I came upon the nearest thing to the chair, the dental engine. What more natural than that I should use on the jaw what is being used on the cranium, for trephining the skull, or in leg fractures for the extensive operation of open reduction of overriding fractures, or for drilling holes in the mandible for the reception of wires to reduce certain types of jaw fractures? In advocating the engine and

special drill to the general practitioner, I am calling attention to an instrument with which he is in daily contact. In this connection, might I add that unless one is carefully trained to use a chisel and mallet on the jawbone, he will cause much swelling. The angulation of the blow is an important consideration. If the chisel and mallet are held improperly, or permitted to strike the bone in a wrong manner, the end result on the jaw is the same as if a jaw had received a blow with a heavy object, i.e., swelling and soreness. If you feel that when you apply the mallet to the chisel against the jawbone, the reaction is not severe, the technic which I shall describe has no value to you. But if you are desirous of giving consideration to an agent which has done much for me, I commend it to you. Whether it definitely simplifies the operation for removal of a deep root or any tooth which is considered to present a difficult or involved problem, I leave to your judgment.

The principle of the drill as I use it consists of the preparation of a path in the bone directed to the root at such strategic point or points as will facilitate the introduction of a lever for elevation or movement of the root. This is no more or less than what the operator would aim to do if he were to use a hand chisel or just a sharp suitable lever, were he not to consider the drill idea. He would endeavor to adjust the lever blade to a point alongside the root as giving him the most effective purchase against the root. The difference between the method of hand pressure and the use of the drill and lever consists in the elimination of the need for bringing into play what is frequently indeed a tremendous degree of arm force with the former; whereas, with the drill and lever, the cutting through the bone to the cementum of the root is quickly and easily effected so that the lever can pass through the bone path to the root. The end-result is the same in both instances. In both methods, we would have to select the same point of vantage for the lever point. The drill aims to permit the lever to reach its objective more easily, more quickly and with definitely less outlay of energy on the operator's part. It is a clean technic, wholly to be dissociated from the conception of the engine cutting bur commonly used by many from time immemorial to bur around a root or to bur away completely a root fragment. The drill makes a clean wound and leaves no shavings of bone which, with the bur technic, might initiate suppuration.

Let us take up a practical case, beginning with a mandibular bicuspid. The roentgenogram shows a normal straight root. The teeth are standing in mesial and distal contact. Forceps are applied and the tooth fractures half-way down. Are we to push our beak forceps downward in order to effect a deeper engagement of the root for a second attempt at delivery of the tooth root? Even if we were to carry out a buccal soft tissue dissection so that there would be no buccal laceration, or if we grant that by a dissection of the lingual soft tissue from the lingual plate of bone, we might be able to pass the beaks down between bone overlying the root and the mucoperiosteum, granting all this, are we not prepared to admit that the gash cut in the bone on the lingual aspect would be something to retard early regeneration? On the other hand, let us suppose that the bone of the mandible is very dense and becomes thicker in buccolingual diameter as we approach the inferior border of the mandible. Would the beak forceps be able to crush through the bone to the root? Hardly. With this procedure out of consideration from the point of view of conservative considerations, the next thought

is, are we to make entry within the alveolus through the fractured area with a lever? That procedure seems to be carried out by many operators. I cannot endorse it. The lever, however delicate or appropriate in form, cannot but bring to bear against the mesially and distally standing teeth a fulcrum and lever stress which will undobutedly result in a postoperative ordeal of some, if not much, intensity. Lever stress at the mesial or the distal aspect of the fractured root cannot avoid injuring the alveolar investment and referring its painful symptoms to the adjacent teeth and the related bone. What then is the logical avenue of approach to the problem of the deep mandibular bicuspid fracture? Is it not through the buccal or labial aspect? This technic which I give you is a definite one and produces successul results invariably. Overheating of the bone is impossible, because the drill does not remain long enough in contact with the bone to generate excess heat.

The incisions for the flap reflection are made mesially and distally to the retained root fragment. Commencing at the ridge line, in the interproximal areas, the incisions flare downward, widening near the base. The incisions are made deep enough to obviate traction on the soft tissues when they are turned down and away from the bone area. If there is excessive or troublesome hemorrhage to confuse the operator, swabs of cotton or gauze dipped in physiologic sodium chloride solution applied at intervals during the operation will materially assist in clearing the field. The flap may be held back either with one of the fingers, or with the periosteotome which was used to reflect it from the bone. A rongeur forceps is now applied to the buccal alveolar plate and the portion of bone between the ridge and the upper surface of the root fracture is cut away. This gives us a clear view of the root with its contiguous relationships. If the buccal portion of bone were not removed, there might be danger of trespassing with the drill on the mesially and distally standing teeth. The drill is now applied to the buccal bone some distance below the point of fracture, and directed at an angle of about 45 degrees through the bone and into the root substance. The drill must not too deeply penetrate the root, else there would be a second fracture when the lever made contact. The angulation of the drill has made it possible to utilize the buccal plate of bone as a suitable fulcrum. Upward manipulation of the lever will readily deliver the bicuspid apex. Should the drill penetrate too far toward the lingual wall, and the upper portion of the root come away when the lever is applied, another opening is to be made nearer the apex. When the root is delivered, the margins of the bone cavity are dressed evenly. All rough, jagged points are scaled down and the wound is irrigated and swabbed out well with physiologic sodium chloride solution. Before reapplying the flap, we must make certain that no particles of bone, tooth or filling material are in the depth of the alveolus. The flap is brought back to its points of detachment. We find that, in some instances, this flap will rest solidly against the bone mesially and distally, so that there is no need for suturing to the tissue from which it has been detached. As a rule, I insert a dressing in the cavity whether the flap is to be sutured or not. This dressing consists of thymol iodide and orthoform equal parts, mixed into a paste with petrolatum. A strip of mercurochrome gauze is well saturated with this paste and introduced into the alveolus. Frequently, this dressing will act as a matrix against which the flap may be adapted to position so that there will be

no need for suturing. When I wish to make doubly sure that the mucoperiosteum will not be drawn away by the lip movements, I pass a curved needle threaded with black silk through the flap and attach it at the forward end. Usually, only one suture is needed, as the posterior portion will not be moved by the lip if the anterior part has been immobilized.

Now if the bicuspid root is curved or hypercementosed, the primary step of removing the buccal wall from the ridge line to the fractured surface serves well to guide the drill. Without the open view thus made possible, the operation would be hazardous to the adjacent teeth. Hypercementosed masses are split in sections by the drill, and in aiming to remove the root thus, we find that we do not have to make quite so large an opening in the dense bone region near the apex.

Another type of case is that of the mandibular bicuspid which has been crowded out of the normal arch alinement and is pointing lingually. This type of extraction occurs frequently enough in everyday practice to warrant some consideration in this paper. The procedure is as follows: A mucoperiosteal flap is reflected labially and the drill directed downward through the buccal plate into the root substance. The lever usually elevates the tooth toward the lingual aspect without much difficulty. Should there be a fracture, the retained fragment may be taken care of by the method employed previously for fractured biscuspid apices.

The efficiency of the drill in the removal of mandibular molar roots which have fractured is very gratifying. I find that I can pass the drill downward from the gingival border under the bifurcation of the roots, creating a bone path for the patholever to enter and make effective purchase. Fulcrum stress is had against the buccal alveolar plate. Usually, both roots may be thus elevated with a single application of the lever. When, by virtue of a divergence or curvature of the mesial and distal roots, only one root is freed, the Winter exolever may be applied to the alveolar wall, holding the root which has not been delivered, and by a gentle turning of the wrist, one is quickly rewarded by the expulsion of the root. I could speak at length on the technic of the exolever. I hope to be able, in a brief exposition, to say something which may materially aid the general practitioner in the handling of this instrument.

The proximal alveolar wall of the tooth adjacent to that being operated on must never be used for fulcrum stress. When a lever is permitted to rest too heavily against bone, there is usually a severe postoperative reaction. For this reason, as we are frequently compelled to bring considerable stress to bear against bone for the delivery of certain types of roots, I wish to make clear the need for removing, at the time of the operation, all fulcrumized bone. This bone is on the buccal aspect of the jaw, and by trimming the buccogingival ridge border, we are eliminating potent factors in postoperative discomfort. If the proximal wall of the alveolus is utilized for fulcrum stress in the exolever technic for root delivery, the bone at that point cannot be removed and the result is a painful bone area, soreness in the contiguous tooth or teeth, and, frequently, progressive inflammatory symptoms of osteitis, commonly known as "dry socket." The exolever, then, should rest against the buccogingival alveolar border of the jaw in the operation for the delivery of the molar root fracture, because it is then possible to remove this bone segment with the curet or with the type of lever combined

with a curet end, which I have styled the curetolever. Thus, distended alveolar margins are not permitted to remain to produce the pain indicative of "dry socket."

"Dry socket" is a result of traumatization of bone. There has been a disorganization of the blood clot, due, in my opinion, to the fact that blood will not coagulate around injured bone. I have heard it claimed that local anesthesia is responsible for these "dry sockets," because of the action of the adrenalin chloride in the anesthetic solution. That is not necessarily so. These conditions follow the use of general anesthesia, as well. This points to the etiology of "dry socket" as being rather associated with trauma and infection which attacks areas of lowered resistance such as alveolar surfaces whose protecting blood clot has been disorganized. I find that the removal of fulcrumized bone at the time of extraction encourages healthy organization of a stable clot and minimizes the onset of symptoms of osteitis.

Treatment of "dry socket" is not difficult. The first step is a warm physiologic sodium chloride or warm sodium perborate irrigation. The alveolus is carefully dried with cotton applicators and a dressing of ethyl aminobenzoate, orthoform, thymol iodide and petrolatum introduced. Roentgen-ray examination, of course, should reassure the operator against the presence of loosened bone or foreign bodies before the dressing is applied. These sockets, on culturing, frequently show a preponderance of Vincent's spirilla. The introduction of a pledget of cotton dipped in arsphenamine-glucose solution for ten minutes before the dressing may aid in controlling the pain. I apply a hot wet towel to the temple on the affected side of the head. The patient should leave the office free from pain, if these measures have been faithfully carried out. I cannot advocate or endorse the popular practice among some members of the profession of curetting "dry sockets" in order to give relief to the suffering patient. I consider such procedures fraught with danger. The spread of infection seems to be favored by such treatment. As far as stimulating a clot in such alveoli is concerned, I can only add that the new clot will break down just as readily as the first one. Until the painful symptoms subside, indicating that the bone seems ready for the support of a clot, none can be or need be encouraged or organized there. Gentle treatment is, in these cases of osteitis, most imperative, if we wish to prevent an osteomyelitis.

I should like to say a few words on the matter of process trimming. A discussion of alveolectomy and alveolotomy could well consume an entire evening. One particular phase of it might be apropos here. I call attention to the cuspid prominences. When the incisor or the bicuspid teeth have been removed for a long while, we find the cuspid teeth standing out very prominently. The original eminence is still more accentuated by reason of the resorptive changes in the mesial and distal edentulous area. When these cuspid teeth require removal, I believe it is well to dissect the labial mucoperiosteum from the bone, and when the teeth are removed, to trim the labial prominent tissue to about the level of the edentulous areas. To do this is to remove at once tissue which will take a long while to resorb and, at the same time, facilitate early and comfortable prosthesis. The maxillary molar regions frequently present eminences buccally which might

give the patient the same postoperative discomfort as the cuspid points, and I am in favor of handling them at the time of the molar extractions.

The mandibular third molars are perhaps the most difficult teeth for the general practitioner to remove, even when they are not complicated by reason of coronal caries or malposition or impaction, partial or complete. I shall not endeavor to go into the matter of impactions. I am devoting my remarks to the general practitioner, and we have much to ponder over without commenting on impactions. It might be far wiser for the general practitioner to delegate this type of surgery to the specialist from the outset. The exercise of good surgical judgment presupposes a recognition by the operator of his capabilities and his limitations, and what I said early in this paper surely concerns impacted teeth.

I wish to give a brief outline of my technic for the removal of a carious mandibular third molar.

The point of entry of the drill is at the mesiobuccogingival angle of the third molar. The path extends into the mesial root cementum. No contact with the second molar is made, either with the drill or with the lever which is applied to the bone path. This is important, because there is a general tendency to employ a spear-pointed lever for third molar removal, resting the blade against the second molar. Traumatization frequently follows, and the patient suffers a sore second molar and a sore jaw. Forceps application is not often possible for the grasping of the carious third molar. The thick buccal ridge so often encountered here prevents beaks, being pushed down to engage the cementum. The drill and lever technic makes an ideal procedure for such operations. Reflection of the mucoperiosteum is made as a preliminary measure to the drill entry when the mesiobuccogingival aspect is obscured by soft tissue or the carious process extends below the gingival border.

What I have presented here is the result of clinical experience. If it differs from your own ideas on the subject matter, I trust that you will judge my opinions purely on the basis of personal experience.

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PREVENTIVE PROSTHESIS*

By M. M. De VAN, D.D.S., Philadelphia, Pa.

THE title "Preventive Prosthesis" is seemingly contradictory. How can prosthesis—the artificial replacement of a lost body part—ever be preventive? The use of the term "preventive prosthesis" would be nothing more than an attempt at alliteration if teeth were the only organs of mastication subject to loss and replacement.

The teeth catch the eye, but the supporting structures of the teeth cannot, and therefore escape attention. The

*Read before the Section on Full Denture Prosthesis at the Seventy-Fourth Annual Session of the American Dental Association, Buffalo, N. Y., Sept. 19, 1932.

much neglected alveolar bone mounts, carries and coordinates these tools of mastication. For teeth are veritable tools, needing the alveolar bone to condition them for use.

It is in connection with alveolar bone that prosthetists may practice prevention.

The tendency to regard alveolar bone as transient, and inseparably linked to natural teeth, has done much to retard preventive prosthesis. As this subject has been dealt with in detail elsewhere,[1] suffice it to say here that there is no essential difference between alveolar bone and skeletal bone except in the matter of sensitivity. If infection is eliminated, and stresses are regulated so that they are neither above nor below the physiologic, there is every reason to believe that alveolar bone will *not* melt away like "snow before the summer sun" after the removal of teeth.

The nondentulous interval (when the patient is without natural or artificial teeth) following extractions is the main reason for much loss of bone. Infection, trauma and disuse atrophy take their toll in alveolar bone.

Alveolar bone, unlike skeletal bone, does not serve as an attachment to muscle tissue, depending almost entirely on occlusion for physiologic stress. Even the few fibers of the buccinator muscles attached to it are active only during mastication. When this fact is appreciated, preventive prosthesis, beginning with instant replacement, will be the goal of prosthetists.

The essential difference between a "profession" and a craft may be thus stated: A profession endeavors to remove conditions necessitating its existence, while a craft may go on trying to render society more and more dependent on its services. To what degree a profession may succeed in eliminating itself is not pertinent to the point.

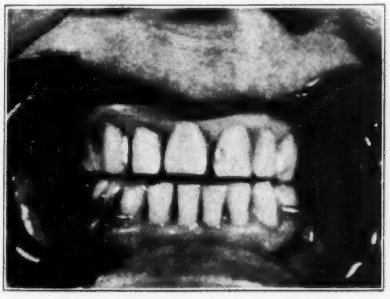

Fig. 1.—Immediate prosthetic replacement. There is a lack of contact of the maxillary anterior denture with the mandibular natural anterior teeth. The height of the labial flange, below and not beyond the line of undercut is the result of prominence of the anterior maxillary ridge.

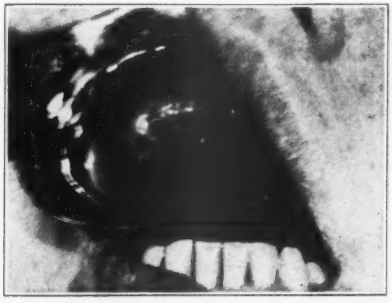

Fig. 2.—Case shown in Figure 1; depicting the prominence of the anterior maxillary ridge. The maxillary teeth had been out four days when the patient first came in. She was advised by a friend not to wait until the gums had healed, as much bone would thus be lost. This case is designated as an "immediate replacement," reserving the term "instant" to those cases in which the denture is constructed prior to extraction and inserted instantly thereafter.

1. De Van, M. M.: Local Factors Involved in Loss of Alveolar Processes, Bull. Virginia D. Soc., 8:65 (Jan.) 1932.

It is not a paradox to assert that we are mysteriously urged on to do the things that work toward our professional undoing, for fate decrees that no peace of mind can come to a man content to treat the ills of mankind without at the same time making efforts to prevent them. The ideal of prevention should have a place in every professional service.

To restore the lost members of the masticatory apparatus may yield the prosthetist a livelihood, but only attempts to conserve alveolar bone will lend professional status to his work.

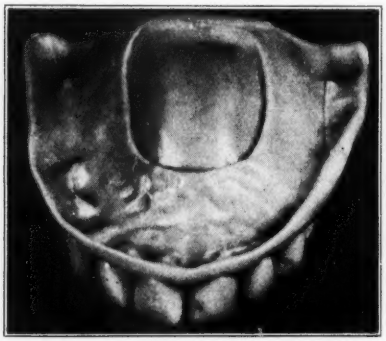

Fig. 3.—Case shown in Figures 1-2; palatal view. The low flanges and the use of a large air chamber are to be noted. The latter is not employed after the mouth has healed, and it is possible to extend the flange height to secure an "outer" peripheral seal. In the presence of undercuts, the use of an air chamber gives an "inner seal." The denture base is a "pyroxylin" material pressed in boiling water. The denture can be quickly made with no trying in.

The goal of treatment should not be the complete reestablishment of lost function, but rather the conservation of the remaining alveolar bone.

I say this because function is always governed by structure, since structure is nothing more than materialized function. The physiologist expresses it by saying that "anatomy is static physiology."

It is well known that a change in function leads to a change in structure, and prosthetists should recognize that the reverse is also true.

We now approach a consideration of supreme importance: in designing dentures, only such functions as are conducive to bone preservation should be provided for.

Prosthetists like surgeons should aim to effect a "working state," not necessarily the "normal state." That certain things can be done with natural dentures does not imply that these same functions are made possible with artificial dentures, any more than that the advantages of artificial dentures (and there are advantages) should be present in the natural.

Fig. 4.—Appearance of anatomic posterior teeth after buccal cusps have been ground out of contact. The patient complained of the dentures "tripping" while eating, and requested that they be refitted. By cutting down the incline planes of the upper and lower buccal cusps both laterally and anteroposteriorly, stresses were materially reduced. This saved rebasing.

We cannot incise or triturate food with artificial dentures to any extent.

Of course, all prosthetists have made

dentures that contradict the foregoing statement, dentures that enabled a patient to eat corn off the cob, bite into an apple, or masticate "grapenuts."

The dental profession has endeavored to attain the unattainable and has met with a measure of success, but full functional power is only temporarily possible. Where areas of extension and compression have been made, subsequently atrophy of alveolar bone occurs. The tenet that suction is a mark of success in making dentures must be given up; the maintenence of the osseous base must be the standard.

When upper anterior teeth are set up,

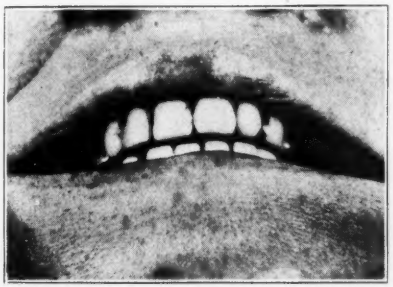

Fig. 5.—Lack of actual contact of anterior teeth. This helps materially to reduce torque, for, in most cases, the incisal edges are located anteriorly to the underlying base. This does not deprive the patient of the use of his anterior teeth, since soft food may be satisfactorily bitten.

it is wiser to be guided by labial and vocal expression rather than by incisive function. It is well to tell the patient that he cannot depend on his front teeth for biting, and that bone conservation, coupled with labial and vocal expression, has determined the set up. He must now rely on the knife and fork.

He has learned that lack of proper use speeded the loss of his own teeth, so he determines to give his new ones the responsibility his natural teeth should have had. He must be advised that this cannot be done. The removable denture must not be expected to do what the natural dentures could well have done.

Having stressed the disadvantages of artificial dentures, I shall now say something about their advantages over a natural, senile set.

The advantages of artificial dentures have not been sufficiently emphasized. The ease with which the mouth may be kept free of food débris and infection is an advantage in the old, who lack the

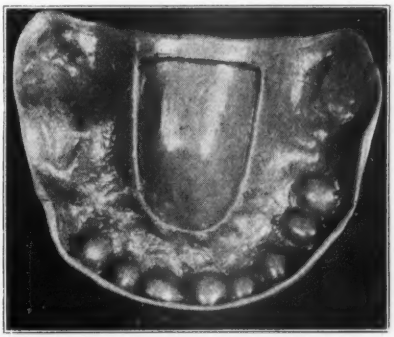

Fig. 6.—Instant replacement; denture constructed before removal of teeth and inserted instantly without even permitting the patient to expectorate. Each artificial tooth is placed where the natural tooth was. This is done by cutting one tooth off at a time from the cast and substituting a porcelain tooth for it. The denture pontics over each tooth to be extracted have been found to so influence bone repair as to give maximum width, which is essential in the maxillae. They tend to reduce the vertical dimension in favor of the horizontal, which provides more room for the setting of artificial teeth.

energy and interest to keep the mouth in proper condition with the senile natural teeth. During old age, the development of nooks and crannies around the

natural teeth is inevitable, and here fermentation, putrefaction and suppuration will go on, unless much time and effort are spent on mouth hygiene.

Even the young must be urged to the proper care of the mouth. The act itself of prophylaxis is not enjoyable, but the consequences of its omission are serious. To appear well groomed, to avoid halitosis, to preserve one's charm are some of the motives for cleanliness of the teeth. As one gets older, these motives lose their edge, and indifference takes their place.

The advantage of less needed expenditure of money may also be cited. In

Fig. 7.—Anteroposterior view, showing postdamming distad from the air chamber.

these days of monetary losses, cost must be an important consideration; and cost will always be an important matter as long as dentistry is practiced as a means of livelihood.

The cost to the operator in energy, time and materials representing true cost is the point to be considered. What the patient is asked to pay is another matter, which depends on the character and ego of the operator. The tendency is away from high fees for dentures. It is obvious that if the operative and prosthetic procedures necessary to recondition the senile natural dentures are perfectly performed, the actual cost in time, energy, skill, risk and alertness will be far beyond that necessary for the construction of the most exacting metal-base full dentures.

The fee charged for any removable denture should never approach that charged in careful fixed restorations. Whether one considers "removable" superior to "fixed" is irrelevant, for fees in keeping with professional service should be collected when such service, and not that of a mechanic, has been rendered.

That good judgment has led to the employment of a mechanic will never justify pocketing of the difference in

Fig. 8.—Photograph taken one year and one month after removal of teeth. A program of preventive prothesis was carefully followed including diet control before and after extraction. There is some vertical loss of alveolar bone, but as yet very slight horizontal loss. Shortly after the teeth were removed, the "instant replacement" was replaced by a gold appliance that harnessed, through the use of occlusal rests, every available tooth, including the anterior. Irregularity of the ridge is due in part to the presence of denture pontics. This is a desirable condition as such a surface is more apt to prevent movement. Our present concept of smooth round ridges as desirable will have to be reconsidered. The mucosa is a coral pink, with every evidence of normalcy around these convolutions.

cost between a professional service and that of a technician, any more than having accepted a technician's findings re-

garding a Wassermann reaction, a physician is justified in charging a patient his own hourly rates therefor.

If the case calls for the work of a mechanic, the portion of time thus spent should, in all fairness, be charged for on that basis.

That a mechanic can perform the service more efficiently than the dentist is no valid counter argument, but merely proves that a mechanic should do that phase of the work. If there is any service that a professional man can, without detriment to himself or his patient, delegate to another, he is duty-bound to do so. In my opinion, there is little that he can delegate to another, if the larger aspects of this problem are appreciated.

"Without detriment to himself or his patient" is an important modification of the foregoing statement. Pages could be devoted to a discussion of the shortcomings of the superdentist with a retinue of underlings, but suffice it to say that the more one sees of laboratory dentures, the more disappointed in them one becomes.

"Why do doctors so often make mistakes?" asks the amiable Amiel in his "Journal Intime." "Because they are not sufficiently individual in their diagnosis or their treatment." He says later: "My principal grievance is that they neglect the real problem which is to seize the unity of the individual who is under their care." The physician-dentist, owing to his better training, is more apt to seize the "unity of the individual," but then he is also apt to feel that he knows too much to do much.

Some time ago, I suddenly and unexpectedly lost the services of a valuable technician who had been with me about five years. I was suddenly forced into the laboratory and certain theories have developed from that experience. To begin with, the appliance means much more to you when you have put more of yourself into its construction. Again, although the appliance may lack the polish of the technician's, it will have incorporated in it more individuality.

I design a case and proceed with its construction only to discover that certain modifications are necessary for that particular patient. It seems that, during construction, my mind is dwelling on the patient's peculiarities, and the

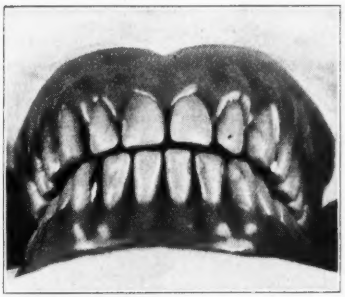

Fig. 9.—View of posterior occlusal form designated as the "P.M.C." form. Stresses transmitted through the posterior teeth are plumbed, minimized and centralized.

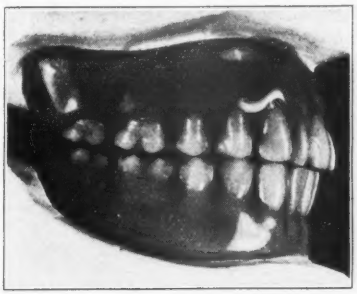

Fig. 10.—Posterior occlusal form ("P.-M.C."). Stresses transmitted through the posterior teeth are plumbed, minimized and centralized.

design is modified. Time spent on the case is simply that much more time given to reflection on it.

Only the prosthodontist who has constructed the appliance is entitled to a professional fee for it. All prosthetic appliances should bear a price commensurate with the energy, time, skill, expense and risk attending their conception and construction.

The prosthesis of one's practice should not be used as the only bolster to hold up income. It should be compelled to yield sufficient compensation for effort and skill, but to use it as a means to maintain a practice is unprofessional.

One may spend hours in prosthetic diagnosis. Study models mounted on adjustable articulators with the patient and roentgenograms on hand may present practical problems sufficient to goad as well as gladden the most ambitious mind.

I am not unmindful of large operative problems, such as the control of dental caries and focal infection, but these belong more to the field of research than to practice.

We have talked at some length about the advantages and the disadvantages of artificial dentures over the senile natural teeth and have advised a careful diagnosis. Before a person is rendered edentulous, he should be told the truth about dentures, for patients are too apt to look on artificial teeth (before they wear them) as a panacea for all their dental ills and deficiencies.

If the confidence of patients is to be maintained, it is necessary to inform them beforehand of the limitations of prosthetic replacement. This we must do before they discover these things for themselves and are surprised thereby. An optician constructing a porcelain eye is not uncomfortable because sight is not conferred with it. A dentist, in like manner, should not feel chagrin because his porcelain teeth do not restore full masticatory powers.

The core of our trouble has been this: we have assumed that the natural functional range could be permanently maintained with full dentures, when, as a matter of fact, only by continual refitting, which means the continual loss of alveolar bone, can any semblance of the full functional range be maintained.

The idea that artificial dentures could be made comparable to natural ones gave great impetus to denture construction. Commercial houses gave the profession what appeared to be better impression technics, more harmonious forms of anterior teeth, posterior teeth of precision, accurate articulating and balancing devices. With their aid, the immediate results were unquestionably superior. Today, after time and experience have permitted a more critical analysis, it is discovered that what has been given is merely a more effective means of harnessing mouth tissues, enabling us to attain spectacular initial results. With chagrin, we have discovered that our provisions for enabling the patient to perform the normal masticatory acts are doomed to be shortlived.

It is true that bilateral balance is operative in resetting the denture after this one sided force has slightly dislodged it, but if alveolar bone is to be preserved, ways and means must be worked out whereby this one sided force is prevented instead of having its dislodging effects nullified. Bilateral balance has given us a sense of false security. The principle of unilateral balance[2] would of necessity

2. MacMillan, H. W.: Unilateral Vs. Bilateral Balanced Occlusion, J.A.D.A., 17:1207 (July) 1930.

cause us to pay greater heed to the laws of leverage. The balance we desire is a permanent balance of forces that makes for osseous stability and not a balance that prevents the dislodgement of the denture.

It is clear that resiliency of the underlying base is not responsible for movements of the denture, but rather the application of pressure in a direction other than the width-center of the underlying base of support.

It is dangerous to the stability of bone to depend on the forces of suction and balance to maintain the stability of the denture. To direct all stresses toward the width center of the underlying base of support should be the aim.

I have had prosthodontists retort that only an extreme theorist could disregard bilateral balance as a factor in comfort. One said: "Just the other day, I got rid of an interfering cusp and the denture became entirely comfortable." I reply: "If the elimination of a single cusp can increase comfort, eliminate them all and note what happens."

Occlusion that is free of inclines reduces torsion. Whether the dentures are balanced in noncentric relationship has nothing to do with comfort, but twisting, swerving and subsequent pinching of the mucosa as the result of every approximation most assuredly has.

The question of comfort and subsequent alveolar stability is inseparably linked with the "stability" of the denture during function.

In the light of preventive prosthesis, whether the denture stays up or down is not pertinent, but rather whether it remains still, without lateral and anterior skidding in the presence of a resistive bolus. Bilateral balance, in a measure, does reseat the denture after a one sided force has slightly dislodged it, but such service is dearly bought at the price of the alveolar bone. It should be employed only when all attempts at unilateral stress absorption are insufficient in attaining unilateral balance.

When the posterior teeth are set up, occlusal support from the opposite side during function should be eliminated as a consideration. Directing of the functional stresses plumbwise to the width center of the underlying mucosa should be the prime thought in mind.

The term "balancing side" is a misnomer, since it does not balance in the presence of a resisting bolus. This factor is operative only during the lateral thrust movements without food resistance between the dentures. It is inoperative when a bolus makes necessary the addition of considerable vertical movements.

Movements in the horizontal plane (lateral and anteroposterior) are only combined with movements in the vertical plane when resistance is offered by the bolus and the degree of such resistance is in direct ratio to the opposition the bolus offers to the mauling action of the teeth.

Peripheral sealing of an impression where flanges hug tightly the enveloping soft tissues will enable the dentist to harness the mucosa for the support of off-ridge posterior teeth. But the cradling, rocking and pinching of the mucosa that goes on during mastication when teeth are designed and set up with no thought of unilateral stress absorption will ultimately so increase denture movements that no extension or compression in the impression will insure the seating of the denture in the presence of a resisting bolus.

The intelligent person will want to know his limitations as well as his capabilities, liabilities and assets. For this

reason, I feel it wise to tell each denture patient about his functional limitations. They are told not to use foods with a resistive index that induces the feeling that the denture is swerving and swiveling on its base. A feeling of denture stability should guide them in food selection. This need not impose nutritional handicaps, for vitamin-bearing resistant foods can be mechanically prepared before consumption.

As previously stated, in all professional pursuits an endeavor to prevent and preserve should be combined with attempts to replace and restore. Preventive prosthesis will have as its goal the conservation to the end of life of the maximum amount of alveolar bone. Less manipulative abuse of the tissues and greater gentleness and considerations for the inexorable laws involved would, in the long run, carry us farther in our desire to serve, for it is only fair to ourselves to keep in mind that normal tooth forms were designed (or evolved) in conjunction with normal natural supporting structures (attachments in alveolar bone). When the one is lost, to expect the other to be normal shows a disregard of natural laws.

Function must be conditioned by existing form, and if, for esthetic reasons, teeth or parts of teeth are set off the ridge, they must be thrown out of functional contact.

When anatomic posterior teeth are employed, the summits of the inclined planes of the buccal cusps and not the sulci should be directly over the crest of the ridge, that is, if even a semblance of unilateral stress absorption is to be hoped for. Doing this with anatomic molds results in a cramped unesthetic arch combined with a crowded tongue. The only other alternative is to set anatomic teeth buccally to the underlying base or cease to use them. Nonanatomic molds have been branded "monstrosities" by the anatomic adherents, yet, in view of the existing edentulous form, the anatomic occlusal scheme may with more justice be thus labeled.

Try this simple experiment: With the ball of the index finger on the center of the forehead, press straight back and note the very slight degree of "give" (resiliency). Now while pressing backward introduce side pressure also, and note the wide range of "skid." The illustration is magnified for emphasis since the normal mucous membrane does not bear so loose a relationship to the underlying osseous base, yet the principles involved are similar.

If the bolus offers any resistance at all (which it must when other than pappy foods are consumed), the stresses developed are transmitted through planes that incline. Since force travels in a straight line and at right angles directly to the surface on which it is applied, it can readily be seen that functional incline planes exaggerate side movements. Anything that decreases functional steadiness will ultimately make for alveolar absorption. This fact alone ought to be enough to taboo the use of anatomic forms on edentulous ridges. Inclined planes on natural teeth were so designed (or evolved) to attain the following results: (1) to permit maximum work at every occlusion, resulting in developmental stimuli to the enveloping bone and muscles and, (2) to induce bone growth in the horizontal direction (lateral and anteroposterior).

When these considerations are understood, one becomes increasingly reluctant to use anatomic molds in denture construction.

With the exception of appearance (which is not a paramount issue with posterior teeth), the anatomic occlusal

scheme is unrivaled in conferring disadvantages. Let us take the first point, when used on edentulous ridges for instance: Who wishes to unleash on the ruins of an edentulous alveolar bone, the combined maximum force of the most powerful group of muscles in the body, namely the muscles of mastication? The shortest distance between two points is a straight line, and the hills and valleys of the natural occlusal surface are primarily designed to present a maximum of contacting points to the resisting bolus. This is an admirable scheme to ensure bone growth during the period of development. It makes for efficiency, just when the developing organism needs it most in its busy program of physical and environmental growth. The avalanche of nonvertical stresses transmitted through these inclined planes made for lateral and anteroposterior osseous development only when a solid three dimensional fixed attachment existed between the teeth and supporting bone.

When the sulci of anatomic posterior teeth are set over the edentulous ridge, it is believed that the resultant line of force is to the crest of the ridge. Even if esthetic requirements and ridge relation permitted this ideal set up, it would not follow when the resisting bolus was being mauled that the resultant pressure would be through the sulci. Only when the teeth are set to a cross-bite arrangement would this be true, but not during function with a normal set up. If we were to examine a lateral cross-section of an upper anatomic posterior tooth, say a second bicuspid, we would find two inclined outer buccal surfaces to every inner one (lingual).

Even when conditions are ideal, incline cusp planes produce lateral horizontal stresses that interfere with our ideal of denture steadiness.

When the cross-bite scheme is used, lateral horizontal stresses are balanced, since the lingual facet of the lingual cusp is nonactive, while the buccal is active.

The anatomic scheme, even when it is thus employed, does not do away with all horizontal stress, for while lateral stresses are eliminated, anteroposterior stresses causing anterior movement are still operative by virtue of the anteroposterior cuspation.

The anatomic scheme is admirably suited to produce "torque" of the mucosa when used in conjunction with a denture base.

In designing posterior teeth, the paramount thought should be unilateral stress absorption. Only forces that fall vertically on the width center of the underlying ridge ought to be permitted.

May I add in closing that the concept of preventive prosthesis or the preservation to the end of life of the maximum amount of alveolar bone will broaden and vitalize prosthetic thought. The physiology and pathology of bone will be delved into, and ways and means of preserving alveolar bone, previously unknown to us, will be the fruit of such endeavors.

4002 Chestnut Street.

DISCUSSION

Lee W. Doxtater, New York City: The thought of preventive prosthesis might well antedate in practice the edentulous stage. I should like to see the natural dentition cared for, if possible, so that prosthesis could be entirely avoided. In those cases in which conditions are found to be such that extraction will be inevitable, we should attempt to have that extraction performed before the supporting bone has been so far invaded by disease that it will offer no practicable support for dentures when they become necessary. Preventive prosthesis also comes into play at the time of extractions, or even later

on, when alveolar form is found to be in need of modification in order that good prosthetic results may be attained. As a factor in this type of preventive prosthesis, roentgenograms of edentulous mouths are essential. These will reveal cysts, unerupted teeth, etc., whose removal is essential to prosthetic success. We can surely agree with Dr. De Van that the preservation of alveolar bone is the first duty of the prosthodontist. This is obvious, but nevertheless may be overlooked in various outbursts of enthusiasm that are apt to be experienced by the worker in this field. I should also like to record my agreement with Dr. De Van regarding overcompression in impression technic. The tissues should never be compressed more than would occur in the course of normal physiologic activity during the taking of an impression. Marked tissue compression in the taking of impressions has been advocated in the past in order to secure extra retention. While such extra retention can be obtained in this manner and while dentures constructed from impressions so taken are exceedingly satisfactory at first, this procedure does not give lasting satisfaction. Dentures so constructed soon lose their retentive qualities and become unstable, owing to tissue atrophy and bone resorption. On the other hand, I cannot see the necessity for making so extreme an effort to avoid slight denture movement as is advocated by Dr. De Van. In the first place, the denture base rests on resilient tissue and some movement is inevitable whenever force is applied to the denture, no matter in which direction. Furthermore, some movement is of value as a tissue stimulant. The effect of compression and the release of pressure on the blood vessels of the part is unquestionably important. I therefore believe that a slight degree of movement might be better than no movement at all. Dr. De Van would have us go to extremes in an effort to avoid denture movement. He finds, for instance, that the incising function has often caused tissue resorption. He seems to have failed to realize that the incising function can be successfully employed without tissue damage if there is an even distribution of stress on both anterior and posterior teeth in the protrusive bite. If the patient has had a decided overbite in the natural dentition, some modification of this overbite must be made when dentures are constructed, in order to avoid premature contact of the incisor teeth. If we follow Dr. De Van to the extent of making dentures which are incapable of the incising function, we shall unquestionably cause antagonism in the minds of our patients on this account and also, more important, on account of the esthetic effect. Dr. De Van has much to say regarding the fact that many dentists have the bulk of their laboratory work done by a mechanic. If we consider the procedure followed by some dentists of taking an impression and sending the unassembled impression and bite to the commercial laboratory, we can go farther than Dr. De Van and say that the dentist should really pay the patient for wearing the resultant denture. On the other hand, when the dentist has a mechanic in his own office whom he has personally trained and who has learned to follow his instructions, the resultant restoration made under the dentists' supervision reflects his knowledge and experience, and is then worthy of a fee commensurate with the years of study and application of the dentist to his chosen work. Dr. De Van comments in a disparaging way on the trade interests, which, according to him, were responsible for giving to the profession the better impression technics, improved tooth forms and accurate articulating devices which we have today. In this connection, I should like to mention with the highest approval the work of Williams, Gysi and Tench. These men gave us scientific developments which, regardless of Dr. De Van's strictures, have immeasurably advanced the art and science of denture construction. I believe it could easily be proved that much of the harm which has come from such procedures as Dr. De Van condemns has been due to superapplication of ideas that they have given us. These men found denture work in a chaotic condition and placed it, almost at a step, on a sound scientific foundation. It would be expecting the superhuman if we were to ask that their work should have resulted in perfection, necessitating no modification throughout the years. Regarding the central thought of Dr. De Van's paper, we find that he proposes a plan of placing artificial teeth in such relation to the ridges that the pressure of the bolus of food will enable the dentures to remain seated even without bilateral balance. His terminology in describing this is open to question, but I will comment only on the term "unilateral balance." Since unilateral means one-sided and since balance is attained by the opposition of two equal forces, it is obvious that there

can be no such thing as "unilateral balance." At the same time, it is conceivable that, in some cases, the setting of the teeth in the manner which he describes may assist in the stabilizing of the dentures. I should like to go on record as stating that equal stability can be gained by providing for bilateral balance and that such stability and freedom from tissue destruction is not dependent on setting the teeth inside the center of the ridge. I will go farther and say that, without bilateral balance, denture stability and tissue conservation are impossible. We must remember that the teeth are in contact much of the time when there is no food in the mouth and that unbalanced contacts at such time are a fruitful source of instability. Dr. De Van cites as authority for his claims MacMillan's illustration of a lower denture stabilized by masticating force which is directed against the buccal cusps of a lower molar set so that this force is received inside the lower ridge. As a matter of fact, this arrangement makes the ridge a fulcrum and the long arm of the lever acting on this fulcrum finds its resistance on the ridge of the other side. This is a splendid example of bilateral balance since the denture is stabilized by downward pressure exerted on the ridges of the opposite sides of the mouth. Dr. De Van's unilateral theory would not work at all if it were not for the fact that he really produces bilateral instead of what he terms "unilateral balance." The entire problem of obtaining stability rests on a bilateral foundation. What we need is the application of common sense to the problem so that dentists will arrange teeth in such a manner that the stress of mastication will be distributed over the greatest area possible. In one case, this may be accomplished by using flat surface tooth forms; in another, by utilizing the curve of Spee; in still another, by omitting one or more teeth. No single expedient can by any stretch of the imagination be regarded as a cure-all. Unquestionably, stillness of the denture during function is desirable from some standpoints, but actually it is unattainable in a strict sense, no matter where the teeth are placed or what their shape. You cannot set a solid on a cushion and keep it quiet while subjecting it to force. It must react according to the resiliency of the tissue. As a matter of fact, inability to attain stability during function makes little difference. It is an ideal, and every logical means to approach it should be adopted. "Unilateral stress resorption" means one sided stress resorption. This means neutral resistance of the other side of the denture and confining the stress to a small area. Bilateral stress distribution to the ridge either above or below is more desirable as it reduces the pressure on any single unit of area. Unilateral stress resorption uses less units of area than bilateral. This whole condition is purely hypothetical even if we can harness the patient to a vertical crushing function, which is abhorred by nature. When we consider Dr. De Van's proposal from the standpoint of comfort, we shall find that there are very few cases in which the tongue will submit to the encroachment of the teeth when set as he recommends. As a matter of fact, Dr. De Van virtually admits this himself when he says that bilateral balance "should be employed only when all attempts at unilateral stress resorption are insufficient in attaining unilateral balance." I will admit that, in some cases, his principle may be a useful one to employ. It need be used only in cases where extreme ridge difficulties are encountered and where the tongue will permit such placing of the teeth inside the ridge. But I must again emphasize that it must in all cases be used in combination with bilateral balance. That this principle of relating the position of the artificial teeth to the ridge is not essential to stability and tissue health is borne out by years of experience in the use of balanced occlusion in conjunction with the usual tooth set up. If properly balanced and free from cusp interference, these cases remain stable and remain free from tissue resorption for many years. The slight movement which often occurs when the bolus of food is crushed does not produce the harmful effects which Dr. De Van ascribes to it. I am inclined to think that, in the cases he describes, he has seen effects of unbalanced dentures without realizing the fact that balance has not been attained. To make this latter point clear, I should like to call attention to the fact that conditions established on an articulator are not invariably the same as those found in the mouth. In the mouth, we are dealing with a resilient base and we have also resilient interarticular cartilage. These tissues may differ in their compressibility and we may thus have an entirely different denture relation in the mouth from that established on the articulator. Because of this fact, the articulator should be used merely as an assembling instrument, the final development

of occlusal balance being brought about in the mouth itself. Abrasive paste is a most valuable means of attaining the needed refinement of balance. I wish to record my agreement with Dr. De Van on the subject of modified tooth form. At the same time, I do not wish it to be understood that I am in favor of any one tooth form or any special type of modification. I think that there are cases for all types and modifications and that still better ones may yet be made. In any event, that dentist will attain the greatest success who visualizes the entire range of problems with which he must deal, who comprehends the entire range of tooth form and denture technics which are at his command and who utilizes the technic and tooth form best adapted to each case as it comes into his hands. It may not be amiss to call attention to the fact that one of the important factors in the selection of tooth forms is the age of the patient. We usually find that the patient who has the proper use of his teeth modifies their form progressively as the years go by, and it is most helpful in denture work to keep this modification and its average rate of progression in mind as a guide in the selection of tooth forms for the edentulous. When we study the progressive modification of tooth form, which goes on in the natural dentition, we observe the gradual elimination of cusp interference as time goes on and we also notice that the health of the natural teeth is in proportion to the patient's ability to get rid of cusp interference. The denture worker may well take a lesson from nature on this point. He will find that the stability and comfort of the dentures that he constructs are in direct relation to his success in avoiding or eliminating cusp interference of the artificial teeth. Proper consideration for this principle, as well as that of bilateral balance, will usually make it unnecessary to resort to the forced and uncomfortable expedient proposed by Dr. De Van.

Dr. De Van: The views expressed in my paper were suggestive rather than instructive; and, under the circumstances, it is inevitable that vagueness should have prevailed. Dr. Sears and I have discussed the question of "bilateral balance" on several occasions. I have tried earnestly to see its advantages as outweighing its disadvantages, but I cannot as yet see the gain worth its cost. It must be understood, of course, that the bilateral balance that I am commenting on is the usual three-dimensional "cuspal incline plane" type. It must be understood that, in centric relationship and within a radius of 2 mm. thereof, simultaneous bilateral contact during the resting state should prevail. This is automatically secured by placing all cutting edges on bite plate surfaces "milled in" by the patient. After this record is secured, we can dismiss all consideration of condylar guidance, for the surface upon which teeth are set is the result of condylar action and in harmony with it. Bilateral balance in vertical position other than the working bite necessitates three dimensional functional records, which, under edentulous conditions, are impossible of attainment. I say this because to record and provide three-dimensional contacts accurately, three-dimensional fixed relationship must exist between the superstructure and its foundation. This will be possible only when the edentulous alveolar bone can be harnessed in the same way that natural teeth harnessed it; namely, by embedding themselves within the substance of osseous tissue. This compulsory departure from Nature's foundational scheme in mucosa bearing appliances renders imperative our departure from Nature's occlusal scheme. It is destructive to the remaining alveolar bone to use a three-dimensional occlusal design in conjunction with a two-dimensional (surface) foundation. We are building on a living base that renders fixed attachments impossible. The only way that alveolar bone can be harnessed is as a two-dimensional base. It follows therefore that the only innocuous occlusion is also two-dimensional. I am not suffering from spleen when I condemn the principle of bilateral balance attained through cuspal incline planes, which invite side movement, rendering the denture pendulous on its base. If alveolar bone is to be preserved, shifting is to be avoided. Dr. Doxtater is confused with the terms resiliency and displaceability. Place a piece of rubber dam over your knuckles and note that while resiliency is negligible (less than the thickness of the dam), displaceability can be as great as the elasticity of the rubber. If we could render stresses vertical to the width center of the underlying mucosa, movement will be limited to true resiliency, which is small indeed. When we fail to do this, movement is considerable, owing not to resiliency but to the factor of displacement. Only the movement resulting from true resiliency is physiologic to alveolar bone. Dr.

Doxtater is again confused when he objects to "unilateral balance" on the basis that bilateral balance would distribute pressure to a greater area. The term "unilateral balance" I have taken from Hugh W. MacMillan. I wish to go on record as saying that I owe much to his stimulating observations. It is assumed that when we talk of bilateral balance, we are referring to occlusal, not to foundational, relations. In the sense that Dr. Doxtater means, it is true that, in mucosa bearing dentures, there is no such thing as unilateral balance, for without the support of the opposite ridge, success at best would be rendered precarious. Yet I would emphasize here that the principle of unilateral balance (an occlusal scheme whereby only stresses, at right angles to the width center of the underlying ridge, are permitted to emanate) would utilize more units of mucosa support than bilateral balance ever can. I hope that Dr. Doxtater will see this point, but I am led to believe, from his remark, that, in mucosa bearing appliances, unilateral balance is a misleading term. Dr. MacMillan uses it in conjunction with natural teeth where each side is independent of the other. This can hardly be said to be the case in mucosa bearing appliances. Possibly the expression "positive balance" would be more descriptive. When vertical stresses are linguad from the width center of the underlying base, the pressure on the opposite side is "positive" and the denture is being pressed more firmly against the opposite ridge during the functional act. Thus, more units would be called into play for positive stress counteraction. When nonvertical stresses are buccally from the width center of the underlying base (this is true of bilateral balance with anatomic molds), the denture is pulled away from the opposite ridge, and the opposite ridge and flange are used in a negative way to prevent dislodgement rather than to absorb positive stress. The opposite ridge is subjected to a "pull" rather than a "push" pressure. I agree with Dr. Doxtater that a slight degree of movement is better than no movement at all. We have before us the example of the resilient periodontal membrane enveloping all roots. I am merely stressing the importance of avoiding movement due to displacing the mucosa, not to compressing it. I fail to see why Dr. Doxtater objects to my efforts to avoid denture movement. I am sure he would have no objection to my rendering natural teeth steady during function. We are dealing with alveolar bone in both instances. It is a characteristic of bone to resist stresses prevalent during its growth, for its internal structure, with its network of trabeculae, is the resultant of such stress. Movement due to resiliency is physiologically absorbed, for such movement was present during its development; but the displacement of the mucous membrane by a "mucosa bearing" appliance carrying the anatomic occlusal design is something new in the life cycle of alveolar bone. Only by avoiding displacement will we permit the stimulating action of resiliency to prevail. What I wish to emphasize is that practically all denture movement with anatomic posterior teeth is due to horizontal displacement of the mucosa. Its vertical displacement (or resiliency) is natural and physiologic, but we should bear in mind that it is negligent in the unabused mucosa. Dr. Doxtater has missed my point entirely when he brands as "a forced and an uncomfortable expedient" the principles I have endeavored to bring to you. I can assure every one who hears or reads my remarks that prosthetic procedures based on the suggestions made will result in appliances with the maximum of comfort; not for a year but for years to come. I do not know what he means by "forced." Patients are requested not forced to refrain from incisive function. They may bite soft food, such as cake or soft sandwiches, but they are told not to attempt an apple or "corn on the cob." We point out to them the dangers to bone stability from such resistive incision. I restate emphatically that bilateral and anteroposterior balance will not prevent denture displacement in the presence of a resistive bolus. It may prevent denture dislodgement, but if alveolar bone is to be preserved, ways and means must be employed whereby mucosa displacement and not denture dislodgement is avoided. The appearance of dentures based on these principles is in advance and not in arrears of those in which bilateral balance and "the natural functional range" are incorporated. It is possible, when incisive function is not a goal, to set the upper anterior teeth and bicuspids more labially (where the natural teeth were), and thus do away with the retruding "far away" appearance that characterize anterior teeth set close to the underlying ridge. Again, more natural tooth forms (pinless anterior teeth [Parks] with their mass of porcelain that can easily be modified in contour or color) can be employed without danger of crowding the tongue.

TECHNICAL PROCEDURE IN DIAGNOSIS AND TREATMENT OF MALOCCLUSION*

By GEORGE W. GRIEVE, D.D.S., Toronto, Canada

I HAVE spent a great many years in developing a technic for the correction of malocclusion with the pin appliance, and I have made every effort to ascertain whether the ribbon arch appliance embodied qualities not possessed by the pin appliance, with the result that my choice still rests with the latter. For some reason, Dr. Angle, who developed both of these appliances, discarded the pin appliance in favor of the ribbon arch appliance, and later, having apparently realized the shortcomings of the ribbon arch appliance, developed still another, the edgewise arch. With this appliance, I have had no actual experience, but I have watched with intense interest its use by other men, and I am still convinced that the pin appliance is the peer of them all, particularly as applied in treatment based upon the theory that malocclusion is the result of a forward displacement of the teeth.

Other appliances, particularly the lingual wire and the ordinary expansion arch, have their place in the practice of orthodontia, and the technic of their use has been well covered by various men, but their application is very limited.

At the Orthodontic Congress, held in London, England, last year, I presented a paper on "Orthodontic Diagnosis." J. Sim Wallace, of London, in the discussion following; said that I had spoken merely about "anatomic diagnosis," which he said was "relatively very simple," and that I had not discussed the various causes of the conditions which we find in malocclusion, or covered the subject from a physiologic point of view. Dr. Wallace defined very clearly my feeble effort, and gave to it an appropriate name, "anatomic diagnosis." He said "how pleased he had been to listen to Dr. Grieve and his rather bold attempt to throw over a system of orthodontics which had been doing a considerable amount of harm for the last thirty years."

The subject of physiologic diagnosis of malocclusion has engaged many brighter minds than mine for years. The efforts of these energetic workers are to be commended, but many of the problems remain unsolved. Wide differences of opinion exist, but the gap is gradually narrowing. I have studied diagnosis only from the standpoint of its application to our every-day problems; hence, the appellation "anatomic diagnosis," but I have arrived at a definite theory and one which appears to be so near the truth that treatment based thereon is producing gratifying results. Suffice it to say that this theory is that malocclusion, in most cases, is the result of a forward displacement of the teeth. Figure 1 illustrates this point clearly, all the teeth in this case having tipped

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forward. Figure 2 shows a forward tipping of the maxillary incisors and cuspid and a bodily forward displacement of the bicuspids and molars. There is also a certain amount of forward drift of the mandibular buccal teeth in this case, although it may not be evident in this illustration.

J. Sim Wallace propounded this theory about thirty years ago, but, unfortunately, few men, apparently, agreed with him until within the past six to ten years. The number who now believe in the forward displacement theory is constantly increasing, and I feel that,

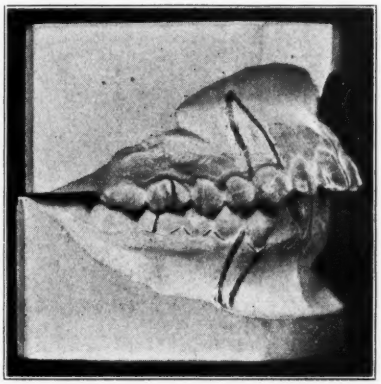

Fig. 1.—Case illustrating theory that malocclusion is result of forward displacement of teeth.

in the near future, this theory may become established as a scientific fact. If so, research as to the cause of malocclusion will make greater progress.

A complication which may eventually follow a marked forward displacement of the teeth is alveolar bone destruction and gum margin recession, particularly on the labial surface of the mandibular incisors. Several years ago, I brought this problem to the attention of A. J. McDonagh, of Toronto, a periodontist of long experience, and with a research type of mind. He is now of the opinion that where the incisors drift forward definitely, the circulation of the blood in the gingiva overlying the labial surface of these teeth is interfered with, and that this is an etiologic factor in the production of the recession of the gingival margin. I am convinced that this is true, and that its correction must be sought by carrying these teeth back to their normal relation to the apical base. It is, then, a problem for the orthodontist rather than the periodontist.

The forward displacement theory of malocclusion suggests to the orthodontist a definite procedure in treatment, and

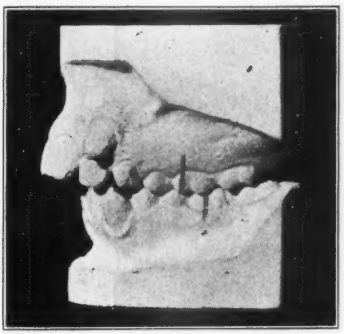

Fig. 2.—Forward tipping of maxillary incisors and cuspid and bodily forward displacement of bicuspids and molars.

when there is some gum margin recession associated with this forward drift of the teeth, the periodontist is at once alive to the cause of the recession, and thus much of the uncertainty which has heretofore existed is eliminated. We have only to remember that teeth do not ordinarily occupy a position distad from normal in relation to the bone in which they are placed. Upon this hypothesis, the technic of application and adjustment of appliances in most cases becomes a somewhat different problem from that with which most of us are familiar, and is

in direct opposition to that which we have believed to be correct. Unfortunately, it also decreases the percentage of cases in which the more simple forms of appliance, such as the ordinary expansion arch and the lingual wire, may be applied.

Before entering into the discussion of the technical procedure of diagnosis and treatment of malocclusion, based upon the theory which I now believe to be correct, I should like to present one of my fairly early cases, the treatment of which was carried out according to the principles generally recognized at that time, and which are still applied by many operators today.

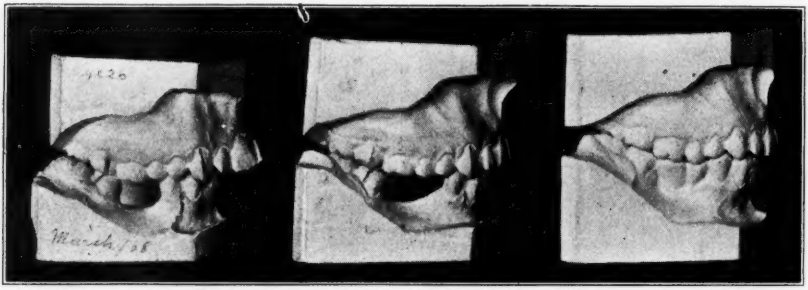

Fig. 3.—Mutilated Class II, first division (Angle) case.

Figure 3 shows the casts of this case, a mutilated one of Class II, first division (Angle). The patient was a man, aged 26 when treatment was commenced in 1908, with ordinary expansion arches.

Dr. Angle introduced his pin and tube appliance in 1910. When that wizard of mechanics gave us this wonderful improvement in appliances, I felt that he had supplied the panacea for most of our orthodontic troubles, and I immediately placed the new appliance in this case, with the result shown, of which I was very proud. In treatment, following the regular procedure, I applied intermaxillary elastics, as many operators are still doing today. This brought about the inevitable forward displacement of the mandibular teeth. The use of elastics here was a mistake, but I did not at that time realize that teeth rarely, if ever, occupy a position distad from normal in relation to the apical base. Some gum margin recession later took place, and the mandibular incisors dropped back and became crowded after the removal of the appliances. The theory of malocclusion upon which treatment was based in this case was wrong, and the final result not at all a credit to orthodontic science, although some improvement was obtained.

There are many men still having similar failures, because of their belief in the same faulty theory. We must not carry teeth forward, and if they are so displaced before treatment is begun, they should, if possible, be carried back to their normal relation to the apical base. When this is not possible, we should resort to extraction, the choice of teeth to be removed being the four first bicuspids, provided there are not present other teeth which are pulpless or carry large fillings, and that all teeth, including the third molars, are present.

When it becomes necessary to remove molars, the problem is very much complicated, and I would advise those who have not had a wide experience to re-

frain from attempting treatment requiring this procedure. Even under the most favorable conditions, in the removal of the first bicuspids, extreme care must be exercised in control of the anchorage, which must be reinforced from the occiput. The higher the technical skill of the operator, and the more cooperative the patient in wearing the hood apparatus, the more favorable the result obtained.

Of course, this type of treatment cannot be successfully carried out with simple appliances such as the ordinary expansion arch and the lingual wire. If the generally recognized theory of malocclusion is correct, the more simple types of appliance have a wide application, but the large percentage of only mediocre results obtained by their use is, I feel, proof that something is radically wrong. It is not necessary here to give illustrations of these failures. Those who have practiced orthodontia for any length of time have had many of these disappointments.

I shall speak briefly of the marking and trimming of the casts, which is covered more fully in the Proceedings of the American Society of Orthodontists for 1925. This is a most important step in the diagnosis, for on it hinges much of the detail of treatment.

Before the plaster for the impression of the maxillary arch is placed, a line about an eighth inch long is marked with an indelible pencil on the white line overlying the median suture of the palate, about opposite the first permanent molars. In this region, this line can be taken as a fairly reliable guide as to the median line of the cranium. The pencil line will be transferred to the impression, at which point a short groove is cut on the cast. This will produce a ridge indicating the median line. When the casts are ready, an appointment is made with the patient to obtain the other landmarks necessary to be recorded on the casts. The first of these will be the relation of the maxillary to the mandibular teeth, which should be marked on the lingual surface. The median line of the face is indicated on the maxillary cast, and this should be, as nearly as possible, a vertical line, as much depends on it.

The mandible should now be studied as to its relation to the rest of the face and to the cranium, and the center of the mandible marked on the mandibular

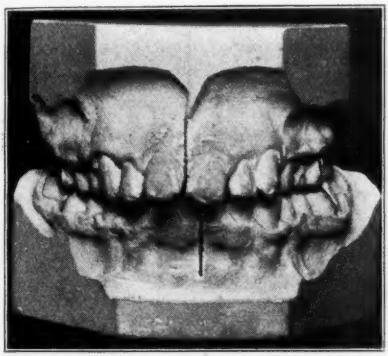

Fig. 4.—Recording of shifting of mandible.

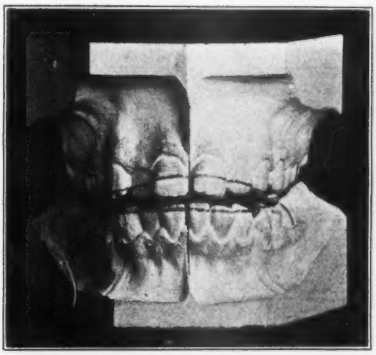

Fig. 5.—Record of resting lip lines.

cast. If the mandible rests true with the remainder of the face, the lines on the two casts will appear as a continuous line. When the mandible is shifted, this fact is recorded, as shown in Figure 4. We shall later revert to this pair of casts to show how one can check up from different points. Figures 7-9 are casts of the same case.

We now record approximately the resting lip lines on the casts, as shown in Figure 5. In this illustration, the casts are separated so that the line of the lower lip may be seen on the mandibular cast. When a person with a normal occlusion, normal overbite and normally developed lips is asked to open the jaws and lips just slightly, the incisal ends of the maxillary incisors should show below the upper lip about the amount of the normal overbite, and the lower incisors should occupy a plane just barely below the upper border of the lower lip. These lines act as a guide to the horizontal plane, and in every case now I intrude the incisors and cuspids to conform to these lip lines approximately.

A deep overbite is, I believe, usually the result of excessive vertical growth in the anterior region, and I treat all my cases according to this theory. When treatment is based upon the opposite hypothesis, and stimulation is applied to increase the vertical height in the posterior region, I am doubtful that any increased height which may be obtained in this way will be permanent, in a large percentage of cases, and I would appreciate any reliable evidence which may be presented to disprove my belief. It, at least, applies in those cases in which the main body of the mandible is shallow vertically. This type of mandible is often found in persons presenting a malocclusion of the second division of Class II (Angle). I do not presume to dictate to Nature concerning the establishment of the plane of occlusion, or curve of Spee, except to intrude the anterior teeth, as before mentioned, and many years' experience in this practice convinces me that Nature takes very kindly to the suggestion.

With these landmarks indicated, the casts are ready for trimming. The first step is to trim the base or bottom of the mandibular cast in its lateral aspect, at a right angle to the vertical line on its anterior surface. In the anteroposterior aspect, it is so trimmed as to place the occlusal surface about on a horizontal

Fig. 6.—Cast marked as to median line, with Hawley chart superposed.

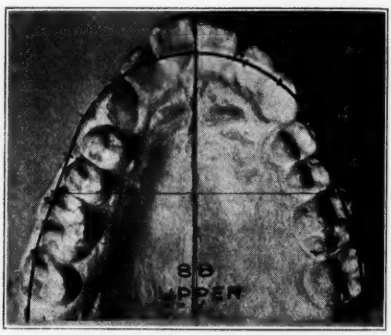

Fig. 7.—Occlusal surface of maxillary cast of case shown in Figure 4.

plane. The casts are now placed with the teeth in occlusion and the necessary measurements made, and the maxillary cast is so marked that the capital or top may be trimmed parallel with the base. Now, the vertical line on the labial surface of the maxillary cast is continued slightly over onto the palatine surface of the incisors. The cast, with occlusal surface up, is then placed under a light string rigged up on a level board, in order that we may sight down on the cast so placed that the two points marked on the occlusal aspect will fall under the string. With a sharp pencil, a number of little dots are placed on the cast perpendicularly under the string, and the cast is removed and these dots connected to complete the line.

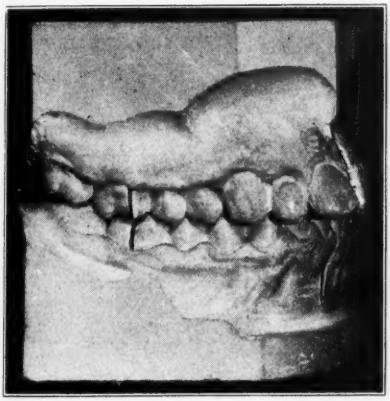

Fig. 8.—Cast showing normal mesiodistal relations.

The equipment for the Simon technic contains an instrument for marking this median line perfectly. Figure 6 shows a cast so marked, but with a Hawley chart superimposed. (These charts I elaborated somewhat by adding the median line and a transverse line to fall at the point of contact between the second bicuspids and molars.) In this cast, the teeth on the right side occupy a position somewhat farther forward than those on the left and, by the use of these charts in this manner, the relation which the buccal teeth on each side bear to the median line becomes evident.

The posterior border of the maxillary cast is now trimmed at a right angle to the median line, and the same surface of the mandibular cast trimmed parallel with that of the maxillary cast. The sides of each cast are now trimmed so that they shall be of equal length and at equal angles to the back, and the cuspid-to-cuspid segments of the maxillary cast so that they shall be of equal length and at equal angles to the sides. The center point between these two segments must be at the median line, regardless of the location of the teeth or the frenum.

Fig. 9.—Left side of cast shown in Figure 8. The lower denture is distad from the upper the width of one cusp.

Figure 4 shows a shift of the mandible to the left. Figure 7 shows the occlusal surface of the maxillary cast of this same case. There is just a little more forward drift of the teeth on the left side than on the right. In Figure 8, we see that the mesiodistal relations on the right

side are normal, and in Figure 9, showing the left side, the lower is distad from the upper the width of one cusp. The shift of the mandible to the left was, no doubt, a factor in establishing the distal relation of the mandibular teeth on this side. This was certainly not a subdivision case, but belonged either to Class I or to the full division of Class II, first division. If in starting the treatment of this case I had realized that there was a definite forward drift of all the teeth, and had removed four bicuspids, this

Fig. 10.—Vertical line marked on profile print.

patient would have been spared many years of useless treatment and I much worry and disappointment.

When I see one of these patients on whose case I had expended much valuable time, with only a mediocre result, a feeling of chagrin comes over me as I realize how simple was the way out of my difficulty. It reminds me of the story of an old colored man who could not straighten up his back one morning. His wife suggested that he must call and see the doctor, which he did, and the doctor found that he had buttoned the top button of his trousers into the second buttonhole of his vest.

Before the patient goes to the photographer, the profile is studied carefully, and an effort is made to pose the head in the normal vertical position. A thin, straight rule is now placed on the vertical plane as near the face as possible, in line with the glabella, and the relation which the anterior border of the chin bears to the rule is noted. The assistant goes with the patient to the photographer and conveys to him approximately the relation which the anterior border of the chin bears to the vertical line. The photog-

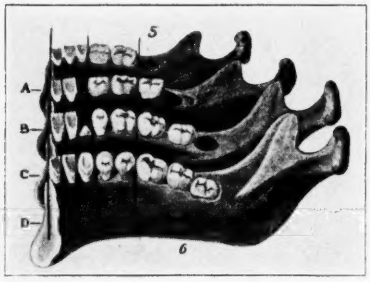

Fig. 11.—Illustration of John Hunter's description of the growth of mandible. (From "The Natural History of the Human Teeth," by Joseph Fox, 1803.)

rapher has a perpendicular line on the ground glass of his camera, and he seeks to pose the patient as instructed. It is not necessary that his technic be very accurate, since the prints are delivered untrimmed. With these, we study the patient's face again, in conjunction with the casts, and the vertical line is marked on the profile print as shown in Figure 10. The sides of the print are then trimmed parallel to this line, and the top and bottom at right angles to it. For practical purposes, this technic fulfils all requirements just as well as the more elaborate,

but still uncertain, one of Simon employing the Frankfort horizontal plane. In the case shown here, we have a maxillary protrusion and a short mandible. Further details will be found in the London paper mentioned above.[1]

The problem of treatment, when based upon the forward displacement theory, becomes very much simplified and is a definite procedure, in most cases differing only in degree. Much of the uncertainty is eliminated. To ascertain the amount of forward drift is quite simple, but to correct it requires good judgment, skilful manipulation of efficient appliances and the cooperation of the patient. Teeth should rarely, if ever, be carried forward in the bone, but if the mandible is short, increased length should be obtained, the teeth thus being carried forward along with the base. This also applies to the maxillae in Class III. Growth normally takes place at the back, as illustrated in Figure 11, taken from J. Sim Wallace's book previously mentioned. Detail technic for obtaining growth of the short mandible may be found in a paper of mine published in the Proceedings of the American Society of Orthodontists in 1925 and elsewhere.[2]

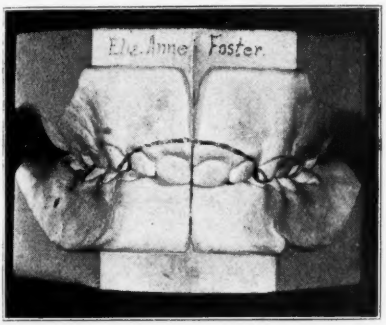

Fig. 12.—Labial aspect of developing case of excessive overbite.

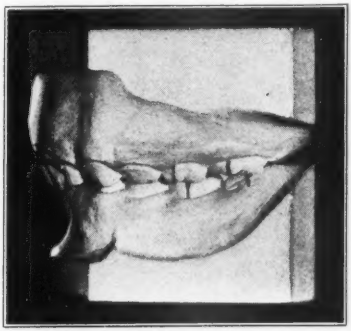

Fig. 13.—Lower buccal aspect of case shown in Figure 12; showing forward drift of maxillary teeth.

It is important that the general practitioner be alert to detect developing malocclusion in its earliest stages. There are many contributing factors, such as habits, abnormal respiration, inertness of muscles of the lips, premature loss or too long retention of deciduous teeth and deficient lateral growth of the dental arches.

Excessive overbite, which is present in a large percentage of mouths, is the result of a forward displacement of the maxillary teeth.[3] Figure 12 shows the labial aspect of the casts of a developing case of this type. The upper lip line upon the maxillary cast is to be noted. This child was just under 7 years of age when the casts were made, and all the deciduous teeth except three lower incisors were still in place. The lips were not functioning normally, requiring a little development. When this is accomplished, the upper lip will rest a little lower. Figure

1. Grieve, G. W.: Internat. J. Orthodontia, 18:927 (Sept.) 1932.

2. Grieve, G. W.: D. Cosmos, 68:321 (April) 1926; Internat. J. Orthodontia, 12:307 (April) 1926.

3. Grieve, G. W.: D. Cosmos, 70:704 (July) 1928.

13 presents the left buccal aspect, showing a forward drift of the maxillary teeth. The child has a normal mandible. Figure 14 shows the right side, where the maxillary teeth are only slightly anterior to their normal relation with the mandibular teeth, but measurements show that both maxillary and mandibular teeth on this side have drifted forward 0.05 inch more than those on the left side. The dental arches were only slightly under normal width. The last of the first permanent molars, the maxillary right, erupted soon after the casts were made.

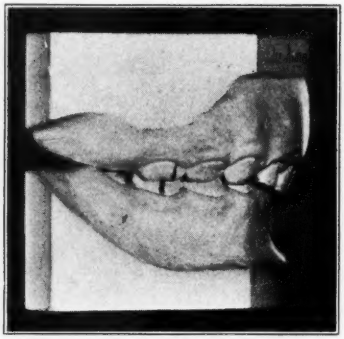

Fig. 14.—Right side of case shown in Figures 12-13. The maxillary teeth are only slightly anterior to their normal relation with the mandibular teeth, but measurements show that both maxillary and mandibular teeth on this side have drifted forward 0.05 inch more than those on the left side.

The treatment of this case is being carried on as follows: A pin appliance, with 0.032 inch arch wire, was placed on the maxillary teeth, with bands on all deciduous molars and cuspids. A spur to engage the traction bar was soldered to the arch wire between the central incisors, and light spurs of flattened wire placed on the arch wire to engage the incisal ends of these teeth to prevent the arch wire's being bent gingivally as a result of the pull of elastics from the hood, which the child is required to wear as much as possible, and at least at night. U springs of 0.022 inch wire were soldered to the arch wire between the cuspids and first deciduous molars, and fitted to rest against the mesial surface of each permanent molar to tip these teeth back to their normal relation to the apical base. A lingual wire was placed on the mandibular teeth to gain the necessary slight expansion, and springs were adjusted to intrude the permanent central incisors. When the maxillary molars

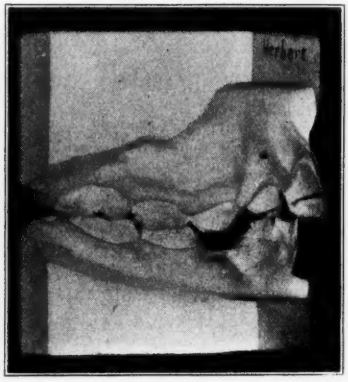

Fig. 15.—Right buccal aspect of cast of boy, aged 10½. Both deciduous cuspids and the mandibular deciduous first molar on this side have been lost and the spaces are quite considerably narrowed.

were back to place, the springs were removed and spurs were soldered to the arch wire to rest against the mesial surface of these teeth to maintain them. The pins for the second deciduous molars were now removed from the arch wire, and U springs, with half-round pins attached, were soldered anteriorly to the cuspids to carry the second deciduous molars back to contact with the permanent molars. When this movement was completed, pins were soldered to the arch

wire for these teeth, and springs, soldered distad from the second deciduous molars, were applied in the same manner to carry back the first deciduous molars, and later the distal movement of the cuspids was similarly accomplished. In the interval, the deciduous maxillary central incisors were shed and the permanent ones began to erupt. At this time, the hood apparatus was discontinued temporarily. As soon as these teeth came down to their normal plane, which they had reached when their crowns were only about one-quarter exposed, spurs from the arch wire were set to engage their incisal ends and check their further eruption, and the hood was again applied.

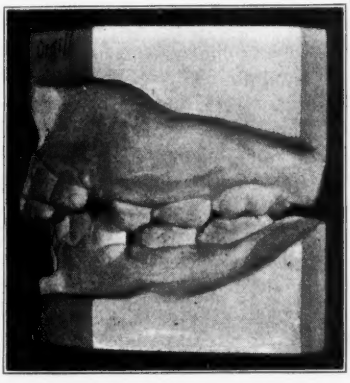

Fig. 16.—Left buccal aspect of cast shown in Figure 15. The maxillary deciduous cuspid and mandibular first deciduous molar on this side are gone, and considerable of the space of the cuspid and most of the space of the molar are closed. The labial displacement of the incisors means that most of the cuspid space has, in reality, been lost.

This is an experiment which is apparently going to be successful. I feel that I should make clear my reason for not permitting these incisors to come to full eruption. With the excessive vertical growth which had already taken place, and the forward position which the maxillary incisors occupied in relation to the mandibular teeth, they would, if their eruption was not checked, come down far below the normal plane of occlusion, and it would later be necessary to intrude them. What I anticipated is, I believe, taking place. Nature is reconstructing the investing tissues, and the gingival margin now occupies a higher plane than formerly, and about two-thirds of the crowns of these teeth are now showing. I expect that this reconstruction will continue until the crowns of the incisors are fully exposed, when the gingival margin will occupy a still higher plane. These teeth are now banded and U springs applied, with half-round pins attached, to carry their roots lingually, and also their crowns if necessary. The molars on the lower right will have to be carried distally a little. This will be accomplished with a pin appliance in the same manner as those of the maxillary arch. The anchorage will be augmented from the maxillary teeth by the application of an intermaxillary elastic, as in the treatment of a Class III case. This technic is routine, except the restraint placed on the eruption of the maxillary central incisors, and is applied in practically all cases when it is decided to carry teeth distally.

Figure 15 shows the right buccal aspect of the casts of a boy, aged 10¼. Both deciduous cuspids and the mandibular deciduous first molar on this side have been lost, and the spaces are quite considerably narrowed. Figure 16 shows the left buccal aspect of these casts. The maxillary deciduous cuspid and mandibular first deciduous molar on this side are gone, and considerable of the space of the cuspid and most of the space of the molar are closed. The labial displacement of the incisors means that most of the cuspid space has, in reality, been lost. It is my opinion that all these spaces

have closed as the result of a forward drift of the posterior teeth. That would mean that, to restore normality, all the posterior teeth must be carried distally, which is virtually impossible, particularly if the third molars are present, as they are in this case.

Pin appliances have been placed on both arches to prevent any further forward drift of the posterior teeth. Both maxillary first deciduous molars and the mandibular left cuspid have been removed, to facilitate the eruption of the first bicuspids. On eruption, these teeth will be removed, and springs will be placed to carry out in detail all necessary distal and lingual movement of both maxillary and mandibular anterior teeth to their normal relation to the apical base. The posterior mandibular teeth in this case may require a little forward movement, but one must be extremely careful that the posterior teeth, particularly the maxillary ones, are not carried forward too far as a result of their having been used for anchorage. If this happens, the spaces are filled before the anterior teeth are back to normal position. It is to prevent this that we advocate the addition of occipital anchorage in nearly all cases when teeth are to be carried back, whether any are removed or not.

Where the four first bicuspids are removed, all possible anchorage is enlisted, and U springs, with half-round pins attached, are placed on the cuspids to carry out the necessary distal movement, intrusion and rotation. When these teeth are in the desired position, pins are placed on the main arch to engage them and springs are attached to obtain similar movement of the lateral and later of the central incisors.

It is important that all six anterior teeth in each arch be intruded sufficiently, and that the roots of the maxillary incisors be carried lingually so that these teeth shall occupy their normal angle of inclination.

The apical ends of the mandibular incisors, in most cases, are usually nearly in the normal position. An odd one may sometimes be crowded forward, and may have to be moved bodily lingually. In most cases, we find the mandibular incisors are tipped forward, requiring only the lingual tipping of their crowns. Only occasionally is it necessary to carry labially either root or crown of a mandibular incisor. This statement probably comes as somewhat of a shock to many, but if this is borne in mind, and we act accordingly, we will be agreeably surprised to find less relapse in the treated cases. I did not conceive this idea yesterday, or last week, but many years ago. Teeth should not, ordinarily, be carried forward, and therefore intermaxillary elastics must not be applied in the treatment of Class II cases. Of course, the maxillary teeth must be carried back, or the mandible lengthened, or a combination of both, as indicated, until maxillary and mandibular incisors are in contact and the overbite is normal.

In the Proceedings of the Eighth International Dental Congress, when published, will be seen a paper on appliance technic in which will be found more details in the handling of the pin appliance. No other appliance is so effective in carrying out treatment based upon the theory of malocclusion which I believe to be the correct one. As far as I know, credit for this theory is due J. Sim Wallace, but I had arrived at the same conclusion before seeing Wallace's book or any of his earlier contributions on this topic. I would strongly urge everyone interested in orthodontia to obtain this book.[4]

4. Wallace, J. S.: Variations in Form of Jaws, New York: William Wood and Company, 1927.

The general practitioner should be able to early detect forward displacement of the teeth from any cause. He must adjust the necessary appliances to maintain the space where a deciduous tooth has been prematurely lost. He should always place metallic fillings in approximal cavities in deciduous molars—not cement, as the latter dissolves and the loss of a certain amount of the normal mesiodistal width occupied by these teeth results.

The forward displacement theory of malocclusion as applied in my practice for the past six years has overcome many difficulties, and shortened immensely the period of treatment in most cases. As an argument for the correctness of this theory, I would state that when treatment based thereon is properly carried out, no retaining appliances whatever are necessary.

12 Bloor Street East.

DISCUSSION

Burton A. Hoffman, Buffalo, N. Y.: I was glad to hear a discussion of the "forward drift of the bicuspids and molars." There is no question as to the truth of this theory, but the degree of success possible in combating it is another question. The result of this forward drift is a serious matter. Dr. Grieve spoke of cases in which alveolar bone absorption and gum recession invariably accompany a marked forward displacement. I have long held to the opinion that the ideal way to combat this type of periodontal disease which afflicts adults is to treat it orthodontically when the patient is a child. These conclusions were reached several years ago after a study of the work of McCall and Box, and it is a satisfaction to note that the idea is being generally accepted. Dr. Grieve's method of recording lip lines seems a valuable addition to treatment. Most of us examine a patient, place appliances and trust these appliances to bring the incisor teeth into the correct place. Any landmarks are a definite help, and his idea of recording lip lines gives us a definite cue as to whether our appliances are producing development in the right direction. It was interesting to hear what was said about the forward drift theory and the treatment to correct this difficulty. There is no question that the forward drift theory is correct in an astonishing number of cases, but the correction of this difficulty, development of bony structure in the back of the mouth, especially in the region of the angle of the mandible, is not easy, and it is a question whether this can be accomplished in any but a very limited number of cases, cases in which the age and metabolic conditions are ideal. There is a question in my mind as to whether the idea of extracting the four bicuspids is advisable in those cases in which conditions for distal development are not ideal. I am inclined to feel that somewhat less radical measures are more to be desired. Dr. Grieve mentioned the fact that it was of great importance to the general practitioner to be alert to recognize developing malocclusion. He mentions many contributing factors, such as habits, abnormal respiration, premature loss of deciduous teeth, and deficient lateral growth of the dental arches. This is a point that cannot be too strongly emphasized. It is easy to examine a patient at the age of 4 or 5 to see how the development of the jaws is proceeding, and if the developmental spacing of the deciduous anterior teeth is not occurring at this age, we know that malocclusion is in store for this patient. So often, the parent comes to the orthodontist with the story that Dr. Blank said to "wait a little while to see what happens," and then when the child is 10 or 11, he sends him to an orthodontist, and it is already late to treat his case under ideal conditions. It should be the simplest thing in the world for Dr. Blank to recognize incipient malocclusion at 5 or 6 years of age.

DIET AND DENTAL CARIES*

By DOUGLAS P. ARNOLD, M.D., Buffalo, N.Y.

ON the subject of dental caries, there is no dearth of literature. Much thought has been expended and much experimentation carried out by both the dental and the medical professions in an effort to solve the problem.

I have no certain or easy road which leads to the prevention or arrest of dental caries; I shall briefly analyze and attempt to correlate the rather varied ideas and conclusions on the subject.

There seems to be a number of different schools of thought on the subject. First, Miller, Black and Williams developed the older theory of etiology, believing caries to be caused by acid production resulting from the growth of acid producing bacteria, such as *Bacillus acidophilus.* Many investigators still believe this to be an important link in the etiologic chain.

Secondly, there is the diet group, or we might almost call it the vitamin group, which is enthusiastically divided against itself.

Then there is the third group, who believe that the saliva in its buffer action, alkalinity, salt content and rate of flow has much to do with prevention of decay.

The fourth group, which I believe to be single contributors, vehemently tear down and adversely, often sarcastically, criticize the other groups singly or collectively, but seem to have no constructive program of their own.

I wish to discuss the vitamin group somewhat more specifically. All the vitamins have been considered. Vitamin A since its separation from vitamin D has not been thought of so much importance in caries unless it be considered for its immunity factor. C. E. Bloch, of Copenhagen, states that children suffering from xerophthalmia, which is a known vitamin A deficiency disease, do not have bad teeth.

Vitamin C has many supporters. Walkhoff, in Germany, and Milton F. Hanke especially and his followers, believe an insufficiency of vitamin C to be responsible for most cases of carious teeth that we see. Although I have carefully read Dr. Hanke's articles, I cannot but feel he is too enthusiastic concerning the rôle vitamin C plays in this condition.

We have no laboratory measurement for vitamin C deficiency and no clinical indication except the development of scurvy, and because of the rather general use of fresh fruits and raw vegetables, scurvy in pediatric practice in United States is a very rare disease, while dental caries is common. Conversely, in countries such as Alaska and Greenland, where fruits and green vegetables are not plentiful, scurvy is prevalent and dental caries uncommon. It seems certain that, in human beings, caries develops in spite of sufficient vitamin C intake. This statement is made recognizing the possibility

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventy-Fourth Annual Session of the American Dental Association, Sept. 15, 1932.

of a so-called prescorbutic stage of vitamin C deficiency. I feel that the problem of dental caries is more complex than a simple vitamin C deficiency.

There is a large group of investigators who believe vitamin D is the important factor in this problem. May Mellanby and many others are of this opinion. If this were specifically true, the condition should be closely allied to rickets. Alfred Hess, who has done much work on the subject and who is an authority, states[1] that, in critically observing rachitic and nonrachitic children, he concluded that there is no definite association between rickets and dental caries.

Frederick F. Tisdall and Dr. and Mrs. Agnew of Toronto have produced experimental caries in rats by feeding a diet low in phosphorus and vitamin D.[2] A diet low in calcium produces periodontal disease. Their work is well done, and the caries that they produce is apparently identical with caries in human beings.

Boyd and Drain *et al.* and R. W. Bunting *et al.*, in their important investigations, conclude that not one vitamin deficiency is at fault, but that dental caries can be prevented or retarded by a properly balanced dietary.

Time does not permit of a minute analysis of the many painstaking investigations and experiments which have been conducted along the lines of causation and prevention of caries. For a more detailed review, I could do no better than to refer you to the excellent article written by Robert Kesel.[3]

1. Hess, A. F., Abramson, Harold: D. Cosmos, 73:849 (Sept.) 1931.

2. Agnew, Mary C.; Agnew, R. G., and Tisdall, F. F.: Production and Prevention of Dental Caries, J.A.D.A., 20:193 (Feb.) 1933.

3. Kesel, R. G.: What Do We Know About Dental Caries? (Critical Review of Recent Investigations), J.A.D.A., 19:903 (June) 1932.

It is unfortunate that no perfect analogy can be drawn between animal experimentation and conditions in human brings. The teeth are different; the reactions to foods are different; the susceptibility to intake of vitamins is different. However, I do not wish to decry this very necessary phase of research.

What is the answer to all of this apparently contradictory evidence? Can it not be correlated and harmonized and some practical conclusions drawn to, at least, greatly reduce the ever-increasing incidence of dental caries?

From clinical observation, I feel certain that diet plays a big rôle in prevention. I am certain that the incidence of dental caries is not so great in my practice or in children who, from the beginning, have had their diet carefully supervised, as it is, for instance, in a general group of school children or clinic patients.

From a clinical standpoint, I should like to observe a group of pregnant women who have followed a hygienic regime, which naturally would include a balanced diet with sufficient vitamin intake. I should like to take care of their offspring from the beginning and be certain that their diet was balanced as to carbohydrates, protein, fat and minerals, and that a sufficient quantity of vitamins C and D was given the first week of life and continued thereafter. It must be emphasized that breast-fed babies need this supervision and addition to the diet just as much as the artifically fed. I should like to have these children receive their solid food early. There is a prevalent idea that children should not be given solids until they have teeth. This, of course, is very wrong.

In spite of the arguments against cereal, I give the babies cereals at 4 to 5 months; vegetables at from 4 to 6 months, and meat at about a year. Children should receive their solid food as solids and

should be taught to chew rather than have their food given as soup, sieved and mushed, as is now so common especially in some parts of the country.

I would insist that children receive fresh air and the proper amount of exposure to the sun.

It seems to me that most investigators have started their studies too late. The child's permanent teeth should be seriously considered at least five to six months before the deciduous teeth erupt; that is, during the time they are in the formative stage.

It is a well-known fact that caries occurs most frequently during periods of stress, i. e., rapid growth and disease. A child doubles its weight the first six months of extrauterine life and trebles it in a year. This is certainly a period of biologic stress and it is the period of tooth formation. Neglecting a concealed tooth is just as inexcusable as overlooking a concealed hemorrhage.

I am endeavoring to emphasize the crying need of early mixed feeding and early addition of vitamins to the diet in order to forestall defects of structure and development with consequent decreased resistance to external noxae (bacteria). This applies even more to premature and immature infants because their growth quotient is greater.

There is another psychologic reason for early addition of food and vitamins, for if these are delayed, the children become opinionated and may refuse to accept these necessary additions to their diet.

Infections of all kinds should be carefully avoided as far as possible. They adversely affect nutrition and also the development, structure and health of the tooth.

If the energy expended and pride occasioned by the eruption of baby's first tooth could be directed into the more practical channels above mentioned, better results could be expected.

Last, but not least, cooperation and frequent consultation between pediatrician and dentist concerning diet, general health and oral hygiene are absolutely necessary.

It is certain that enamel faults such as pits and fissures, incrustations, pockets and areas of decay are hiding places for detritus and bacteria and their pent-up acid products of growth. These must be taken care of and cleaned up.

From an esthetic as well as a practical standpoint, I believe in mouth cleanliness. I am well aware that dirty teeth sometimes do not decay, but this is in spite of and not because of the neglect. With proper mouth cleanliness, I do not believe that the transient passage of carbohydrate food or candy has any harmful effect. In fact, carbohydrates are very necessary to child growth. Naturally, they must not crowd out or take the place of the other food elements.

Summing up the present knowledge concerning the etiology of dental caries and the prevention and arrest of dental caries, I feel that the answer to the problem must be found in a combination and correlation of the facts gleaned and not by an overenthusiastic adherence to one phase of the subject. Any new discovery must result from a combination of research and careful statistical clinical study.

I wish to register my antipathy for the dietetic fanatics. Their statements are not based on scientific facts, but are the result of arm-chair research. This is due to ignorance or desire for publicity or monetary gain. An example of this is the doctrine of incompatibility of food elements, such as protein and starch.

I have seen such statements published in the lay press the last few days. To the

untrained mind, some of these statements sound logical, and they will attract a certain number of followers. To the remainder of the public, they are quite confusing.

In conclusion, I sincerely hope for increasingly closer cooperation between the two professions of dentistry and medicine which will prove of benefit to ourselves and to our patients.

VARIATIONS IN NORMAL ANATOMIC STRUCTURE*

By WILTON W. COGSWELL, D.D.S., F.A.C.D., Colorado Springs, Colo.

IT is most interesting to review dental literature having to do with the removal of teeth and to note the different objectives which were considered most important by the various writers of the day. Primitive surgery for the removal of teeth was most concerned with the immediate relief of pain. With the development of more efficient mechanical aids, rapid extraction was considered important, until, with the advent of anesthetics, there began a period of discussion on operative technic. The use of the roentgen rays induced a progressive series of articles dealing first with retained roots and unerupted teeth, and then, on the recognition of the systemic significance of pathologic areas, came discussions regarding treatment of cysts, residual areas, etc. It was at this time that true surgery for the removal of teeth made its appearance, with interest centering mainly in the preparation of the dental ridges for the support and retention of dentures. Following this came the surgical removal of teeth, the design of mucoperiosteal flaps, the question of bone resection, curettage and various methods of instrumentation. Postoperative disturbances, pain, trismus and trauma came in for a great deal of discussion, which continues.

While great effort has been expended in scientific research along the lines of physiology, pathology and materia medica in an attempt to solve the problem of postoperative pain, the results have consisted principally in the development of palliative measures. The studies which resulted in the following findings were instigated by the belief that except in acute pathologic cases, postoperative pain was the result of operative trauma. Cases in which teeth are seemingly similar in form and position may present entirely different surgical and postoperative results. Surgical methods are not so dependent on tooth form and position as on the form, composition and relation of the investing structures to the teeth. A great deal has been written on the subject of the classifications of tooth form and the tooth's position in the dental ridge, all of which adds to the fund of knowledge regarding anatomy, enabling one to better visualize and discuss surgical problems. Though of great importance in the surgical technic to be employed, the numerous positions that teeth may assume in the dental ridge present a study in abnormal anatomy. Surgical

*Read before the American Society of Oral Surgeons and Exodontists, Buffalo, N. Y., Sept. 9, 1932.

methods are more concerned with variations in the normal anatomic structure of the investing tissues of the teeth and their adjacent tissues.

These variations present an intensely interesting study, and we see a practical application of our findings to surgical problems in all parts of the oral cavity. The discussion here will include only those variations found in the lower molar region, where a large proportion of operative difficulties are encountered. Here is found an outstanding variation from the normal; i. e., in the ramus of the mandible in its relation to the dental ridge, and also in the retromolar intermaxillary mucosa, both of which determine the surgical technic for the removal of the lower molars, extending their influence in this respect to the upper molar region. The classification of the position of a third molar is of negligible value when not accompanied by a qualifying classification of the ramus relation; and a surgical technic for the removal of any lower molar, when not based on such anatomic relation, may prove inefficient.

The classification of the ramus position is based on its mesiodistal relation to the distal surface of the second molar, which is taken as an arbitrary point from which to measure. As the third molar is more often missing, or is impacted, the distal surface of the second molar, a tooth more apt to be present in the dental ridge, is taken as a comparative landmark. It is found that the anterior border or external oblique line of the ramus may vary 2 cm. mesiodistally in its relation to the molar teeth. Utilizing the distal surface of the second molar as a guide, a Class 1 ramus is in the extreme distal position which it may assume, the anterior border rising posteriorly to a fully erupted third molar crown. A Class 2 ramus is the central mesiodistal relation in which the anterior border rises just distad from the second molar crown. The Class 3 ramus is in the extreme mesial position which it may assume, the external oblique line rising above the dental ridge opposite the mesial buccal cusp of the second molar. The external oblique line, or true anterior border of the ramus, thus varies mesiodistally the full distance of two molar spaces.

The influence which such an anatomic variation exerts on the various osseous structures investing the molar teeth can be better visualized if it is possible to imagine the dental ridge, carrying the three molars, as being forced backward partially into the ramus through the retromolar triangle. As the ramus moves forward from a Class 1 position, in which the dental ridge of the third molar space is fully developed, to that of the extreme mesial position (Class 3), the accompanying bone encroaches on the third molar crown and at times on the distal cusps of the second molar. There is also a marked thickening and shortening of the buccal alveolar plate.

A Class 1 ramus presents the three molar teeth as having a long buccal plate dropping abruptly from its crest. In a Class 2 ramus, the buccal plate of the third molar has almost disappeared and a substitution of the bone of the ramus occurs extending forward to thicken and shorten the buccal plate of the second molar. With a Class 3 ramus, the crown of the third molar lies within the body of the ramus and the buccal plate of the second molar flares sharply to join the internal surface of the external oblique ridge. The buccal plate of the first molar is thickened and shortened. Such osseous changes materially alter the extent and type of surgical work necessary in this region.

The influence of the ramus position is

directly reflected in the position of the retromolar intermaxillary mucosa. The pterygomaxillary tendon, having its origin from the hamular process of the internal pterygoid plate of the sphenoid bone and its insertion in the internal oblique line of the mandible, forms a fibrous raphe between the buccinator and superior constrictor muscles. The oral surface of this intermaxillary muscular wall is underlaid with a mass of delicate areolar tissue in the region of the mucosa of the cheek and the walls of the throat. Its superior and inferior borders form the mucoperiosteal fold at its junction with the gum tissue buccally from the molar teeth and distad from the lower third molar and tuberosity of the maxilla.

With a Class 1 ramus, this intermaxillary mucosa curves well backward from its superior and inferior borders at the distal aspect, leaving in relief the tuberosity of the maxilla and the third molar area below, and permits a long buccal plate to be covered with gum tissue. The three molars are found surrounded by true gum tissue extending around the distal surface of the third molar and well down over the buccal plate of all three molars to a deep mucoperiosteal fold. If the third molar is missing, or completely submerged, its space consists of a long horizontal section of the dental ridge covered with true gum tissue.

As the ramus assumes a more forward position in relation to the second molar, the pterygomaxillary tendon and its attached and overlying tissues move forward, causing the mucosa and underlying areolar tissue to encroach on the tuberosity above and the third molar space below. The true gum tissue of the third molar space is displaced by a delicate areolar tissue and the depth of the mucoperiosteal fold is considerably lessened.

In Class 3 cases, the advanced position of the mucosa may cause it to overlie the molar teeth as far forward as the distal cusps of the second molar. The mucoperiosteal fold toward the buccal aspect lies close to the gingival crest of the first and second molars. The entire picture is one wherein the posterior teeth appear to be smothered in soft tissue folds.

The ease with which the cheek tissues are retracted varies, providing ready access to the operative field in Class 1 and a limited access in Class 3. The resulting trauma from cheek retraction is therefore more marked in the advanced position of the ramus.

In dealing with impacted lower third molars, it is not at all difficult to visualize the difference in operative requirements, when, in one case, entrance to the impacted tooth is gained through a broad horizontal dental ridge covered with a hardy gum tissue; while, in another case, entrance must be made through a mass of delicate areolar tissue, which traumatizes easily, to be followed by a much deeper operation through bone for tooth removal.

Nor is it difficult to anticipate the difference in postoperative disturbances. The same problems are presented in surgery of the buccal tissue of the three molars in gaining access to fractured roots requiring a mucoperiosteal flap formation and alveolar resection. Surgical difficulties and postoperative disturbances increase in direct ratio with the advance of the ramus position. These variations have to do only with normal structure and are further complicated by the occurrence in this region of marked deviations in tooth form and position.

We speak freely of the removal of impacted third molars and designate their position by their angle of inclination. Thus, their position has been accepted as denoting the difficulties of the operation.

Such an inference in incorrect as the removal of an impacted third molar, irrespective of its position, which is modified by a Class 1 ramus, is accompanied by fewer operative difficulties than were it encountered in a Class 2 or 3 case.

The classification of the ramus may be made from the roentgenographic evidence by the relative position of the shadow of its anterior border to that of the second molar. A clinical examination may slightly modify the classification as the internal oblique line may not advance in exactly the same proportion as the external oblique ridge. The forward encroachment of bone and mucosa is thus more limited over the lingual cusps of the second or third molars.

It would be with considerable hesitation that these conclusions are called to your attention had they not been substantiated by an extensive clinical experience.

DISCUSSION

Leslie M. Fitzgerald, Dubuque, Iowa: I may say, before I read my prepared discussion, that I have a little different point of view regarding Dr. Cogswell's paper since having a conference with him, hearing comments and seeing his slides. The removal of teeth was elevated to its rightful place in the field of surgery when the dental profession began to think in terms of surgery, bacteriology, pathology and asepsis. This advancement came hand in hand with, and was given the desired impetus by the advent of the roentgen rays and improved anesthesia technic. Before this time, we were unable to diagnose our cases accurately, we did not know of the harmful effects caused by the presence of retained roots, impacted teeth, residual areas of infection and cysts; nor did we realize the importance of focal infection. Even if these conditions had been revealed by the roentgen rays, it would have been impossible to eradicate them without anesthesia. It is true a great deal has been written regarding postoperative pain and disturbances, and this problem still demands consideration. There is no question that trauma is a big factor in postoperative complications and a great deal of time and study have been given in an effort to standardize some technic so as to reduce the amount of operative trauma. These studies have resulted in a more definite knowledge and classification of the position of the impacted tooth, a better roentgenologic technic and a better operative technic. Dr. Cogswell has described three variations of the ramus of the mandible which he feels are of greater importance as regards surgical procedure and postoperative results than the classification of tooth form and the tooth position in the dental ridge. These conclusions, I felt, deserved a serious and thorough analysis. Therefore, I began a study of mandibles in the anatomy department of the State University of Iowa. The results of my study after examining 425 were as follows: Sixty-five were edentulous, and sixty-eight were partially edentulous; that is, the molars had been extracted previous to the death of the person. Of the remaining 292, there were nineteen, in which the external oblique line or anterior border of the ramus appeared to arise posteriorly to a fully developed third molar, and, in these cases, I found a well-developed mandible and maxilla, usually, with teeth in good occlusion, i. e., 6.5 per cent were in Class 1 as described by Dr. Cogswell. I found 253 in which the anterior border appeared to rise just distad from the second molar; i. e., about 86 per cent were in Class 2. In the remaining twenty, the anterior border appeared to rise opposite the mesial cusp of the second molar; i. e., about 7 per cent were in Class 3. From this study, I feel that the majority of impactions appear in those mandibles which present the Class 3 ramus and that we find few impactions of the third molars in well-developed mandibles, i. e., in Class 1. It is true that when we do find impacted third molars in a fairly well developed mandible, they are usually easier to remove, but when these teeth are present and should be removed in the other type, we necessarily must make our approach through the tissue overlying the tooth regardless of the position of the external oblique ridge. In other words, while the position of the ramus and the type of overlying tissue will, to some degree, determine the amount of difficulty to be encountered, what is there to do about it except to keep in mind that we must use the utmost care and reduce the amount of trauma to the minimum? I feel that the surgical procedure is very dependent on the position of the tooth. The roentgenologic examination ad-

vocated by George Winter and others is very valuable in revealing tooth form, tooth position and density and contour of bone. Though the results of my study do not permit me to agree with Dr. Cogswell on the degree of importance of the position of the external oblique ridge, this discourse on the ramus and overlying tissues is enlightening and may stimulate the dental profession to further thought and study of osteology and histology.

Dr. Cogswell: I appreciate the fact that Dr. Fitzgerald was at a disadvantage in not having duplicates of my slides when preparing his discussion. Study for an accurate classification of the ramus position should not be made from dehydrated specimens, and cannot be made from mandibles from which the third molars have been removed. If classifications were to be made from dehydrated specimens with the impacted third molars still in position, the variations would be obvious. Classification must be made in the mouth. We should watch for the typical "smothered" appearance of the molar teeth by the mucosa of the retromolar soft tissue and the fold of the cheek in Class 3 cases and note the difference in third molar mucoperiosteal flap formation from those of Class 1 cases. Dr. Fitzgerald asks, "What is there to do about it?" There are two or three things we may do. In the Class 3 ramus, when we are confronted with difficult accessibility, we must limit the mucoperiosteal flap to a short flap on the buccal aspect of the tooth. If this is not done, trauma of the mucoperiosteal fold and postoperative pain results. The length of the distal incision for exposure of a third molar impaction, in a Class 3 ramus, must be limited. In a Class 3, the incision may be carried distally for a matter of but a few millimeters, where it begins to climb a vertical wall of oral tissue. The manipulation of soft tissue should be limited and, as some have advocated, the division of tooth substance becomes preferable to its removal in larger sections. Certainly, in an extreme case, such as a Class 3, every care is warranted in handling these tissues. At times, even in a Class 2 case, trauma caused from excessive manipulation of overlying tissue, causes postoperative pain and soreness extending into the throat. I ask that you, in your clinical and roentgen-ray examinations, note the difference leading to these classifications. Since classifying the ramus according to its position, we have found that men were attempting the removal of impacted third molars, unaware of the difficulties of the case. Now, they more readily recognize the difficult impactions and, instead of referring them secondhanded, refer them without any attempt at their removal. I think it is common in our experience to have men say "I did not realize that this impaction was so difficult. It looked like this other one, in which I got the tooth out so nicely." The truth is that, on comparing cases by means of roentgen-ray examination, his easy case was a Class 1 and his failure occurred in a Class 3. There is a great deal of difference in operative difficulties when we are called on to gain access to any tooth substance through a horizontal plane of hardy gum tissue which is easily accessible for instrumentation, on the one hand and, on the other, as in a Class 3 case, to be forced to penetrate through a heavy mass of soft overlying structure and remove the impacted third molar from within the body of the ramus.

A RÉSUMÉ OF THE DEVELOPMENT OF ORGANIZED DENTISTRY IN AMERICA AND THE PRESENT STATUS OF THE AMERICAN DENTAL ASSOCIATION*

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PRIOR to 1834, only ninety-nine years ago, there was no dental society, no dental college, no dental journal and no dental law in the United States, and there were probably less than 1,000 persons calling themselves dentists. There were in reality few truly professional men practicing dentistry, and very few who had vision and could foresee the needs of an organized profession. In those days, each man jealously guarded his knowledge as his sole property, to be used for his own benefit and profit, and when imparted either to a patient or to a student who might be learning to practice dentistry, it was usually given in a manner to emphasize that no one else possessed like knowledge or skill.

There were among these thousand or less who called themselves dentists a few men with scientific and altruistic minds —men who had vision and who possessed a determination to "separate the wheat from the chaff," to clean up, as it were, a calling or trade and to elevate its better efforts to higher planes.

Just prior to and during 1837, there existed in this nation an economic condition similar in some respects to the one through which we have just recently passed, a great "panic" as it was then called, which caused financial failure and ruin in many vocational and business pursuits. Most men found it difficult to make a living, and thousands, having observed the success a few individuals had achieved for themselves, in creating what were believed to be honorable names, professional reputations and a supposed lucrative income, in the practice of dentistry, took up this profession for a livelihood. They believed that in the practice of dentistry the financial return would be larger and more certain than in any other field in which they might engage, and since at that time there was no restraint on them, nor law controlling dentistry, it is not strange that the great majority were unqualified and incompetent, with no professional background or training.

This great influx of "tooth carpenters," many of them unscrupulous quacks having practically no training or scientific knowledge, caused the few really professional men in dentistry to realize that something must be done to "stem the tide" and prevent the further entrance of dentists of such low caliber into the profession. Notable among these was Horace Hayden, a physician interested in the profession of dentistry, who, as early as 1817, or nearly twenty years before there was any concerted movement toward organization, had suggested the impor-

*Read before the Colorado State Dental Society, June 19, 1933. (A similar communication was delivered before various other state societies.)

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tance of assembling the dentists of the country in a national convention. There had developed in the minds of the better men in the profession a recognition of four primary requisites if progress were to be made: (1) greater and wider knowledge and more expert skill; (2) a means for the dissemination of knowledge pertaining to the profession; (3) exclusion of the unqualified from engaging in the practice of dentistry, and (4) legal and ethical control of the actions of men in the profession toward one another, and toward their patients.

To supply these great needs, organization was necessary, and this was developed along four lines, the influence of which has been fundamental in promoting the elevation of dentistry to a higher plane: (1) the organization of dental associations and societies among selected members of the profession; (2) the development of dental literature for the dissemination of knowledge to the members of the profession; (3) the founding of specialized institutions of learning, namely, dental colleges, for the education of dentists, and (4) the enactment of dental laws for the protection of the public as well as for the guidance and protection of the profession.

The first noted effort toward organization was made in 1834, when an association of dentists was formed in New York City. Some time later, another association was formed in western New York, but no record of its proceedings seems to be in existence. In 1839, a publication, *The Journal of Dental Science,* made its appearance. Aug. 18, 1840, the idea long ago conceived by Dr. Hayden became a reality, and a national convention of dentists was held in the American Hotel in New York City, resulting in the organization of the American Society of Dental Surgeons.

Article 1 of the constitution adopted by this society read:

> The objects of this society are to promote union and harmony among all respectable and well informed Dental Surgeons; to advance the science by free communication and inter-change of sentiments, either written or verbal, between members of the society, both in this and other countries; in fine, to give character and respectability to the profession, by establishing a line of distinction between the truly meritorious and skillful and such as riot in the ill gotten fruit of unblushing impudence and empiricism.

Nov. 3, 1840, the Baltimore College of Dental Surgery, at Baltimore, Md., offered its first course in dental instruction. Here, we find the culmination of the efforts of many years of Chapin A. Harris. Dr. Harris had begun his professional career as a licensed practitioner of medicine at Greenfield, Ohio, but in 1827 he became interested in the practice of dental surgery, and he later went to Baltimore, where he confined his practice to this specialty, finally organizing the first dental college.

Dental education as we now know it was conceived in Ohio by Dr. Harris and his colleagues, although parturition took place in Maryland. This new conception afforded a fertile field in which latent ability might develop into scientific and mechanical endeavor, and presented conditions in which there was produced a living reality, is now an outstanding institution in this country, the dental college. The experience, wisdom and mature thought of Horace Hayden, coupled with the vigor, energy and devotion of Chapin A. Harris, formed a creative and constructive force which for the American profession of dentistry resulted in the development of the dental society, the dental journal and the dental college.

Dec. 31, 1841, the first legislation relative to restrictions in the practice of dentistry in the United States was en-

acted by the State of Alabama, which amended its medical act to include a dentist on its examining board. This law, which went into effect in December, 1842, provided for the licensing of dentists to practice in that state and prescribed penalties for violation of the law.

Thus we note briefly the conditions prevailing in the United States at the time that our dental forefathers created what we now know as the profession of dentistry in America.

As previously stated, the efforts of Dr. Hayden, who is properly termed the Father of American Dental Societies, succeeded in establishing the first national convention. This organization lived but sixteen years. After its dissolution, Dr. Hayden said that he had not entirely approved of the principles upon which the society had been founded, and that in his opinion there had not been circumspection enough in the required qualifications for admittance to membership.

The main object of the organization had been lost sight of in agitation over the "amalgam question," the burning issue of the time in dentistry. Discussions for and against the use of amalgam, or "mineral paste" as it was termed, for filling cavities in teeth, were numerous and violent. This material was condemned by many of the more able men in the profession, though it had some worthy proponents. Much wrangling occurred, and the antagonism thereby engendered brought about the passing of a resolution by the society, in 1843, in which the use of amalgam as a filling material was declared to be malpractice. Some practitioners persisted in its use and were expelled from the society; many others withdrew from the society. Most of the members became disgusted and would not attend the meetings, and so at New York City, on the first Tuesday in August, 1865, the American Society of Dental Surgeons adjourned "sine die," because a quorum could not be obtained to hold the meeting.

While the society was in the agony of disintegration, a new organization was formed in Philadelphia, in 1855, and named the American Dental Convention. The plan of this association was more democratic, and it was hoped that the rocks upon which the other society had been wrecked would be avoided. These hopes did not materialize, for in 1875, twenty years after its organization, it too was dissolved. The American Dental Convention had failed to meet the demands of the then rapidly growing profession, not because of its organic laws or want of laws, but because of its unlimited latitude in the admission of members.

Again the serious minded better element of the profession, who had dropped out of the American Dental Convention, organized under the leadership of J. H. McQuillen of Philadelphia, and named their society the American Dental Association. This Association was organized at Niagara Falls in August, 1859, W. W. Allport of Chicago presiding over the meeting. Jonathan Taft of Cincinnati, Ohio, acted as secretary, and J. W. McQuillen, William M. Wright and Joseph Richardson were elected a committee to draft a constitution and by-laws, which were adopted at the next meeting of the newly formed association.

In 1876, when the American Dental Association had been organized but seventeen years, it was said in the "History of Dental and Oral Science" that: "This association, conceived at a period apparently the most inauspicious and rocked in the cradle of adversity, has gained fair proportions, and has exercised

a powerful influence in the profession by stimulating individual and associated effort."

The secession of the southern states from the Union to form the Confederate States of America in 1860-1861 drew from the membership of the American Dental Association those dentists residing in the Confederacy. They in due time organized the Southern Dental Association.

An influence which caused the membership in both of these organizations (the American Dental Association and the Southern Dental Association) to grow rapidly after the close of the war in 1865 was the desire of dentists to seek help to resist the exactions of the Dental Vulcanite Company under the Cummings' patent. This patent later became the property of the Goodyear Company, which issued to dentists, for various sums, licenses to use a process for making vulcanite artificial dentures and, through the sale of such licenses, collected a heavy toll in royalty from the dental profession. When dentists found that dental organizations were resisting this imposition, they sought protection by endeavoring to join those already existing or to organize new dental societies. It was interesting to me to note that the Illinois State Dental Society was organized under stress of the Cummings' patent evil, July 24, 1865, in Chicago, and that at this first meeting Dr. Wetherbee, of Boston, appeared before the assembled dentists and solicited aid for the benefit of the Boston Dental Protective Union, which was defending a suit to determine the validity of the Cummings' patent.

The patent evil continued for a number of years or until Josiah Bacon, treasurer of the Dental Vulcanite Company, "because of his arbitrary methods and meanness in dealing with the dental profession," was shot and killed by a San Francisco dentist. After a long and bitter legal battle, the patent was finally declared void.

It is interesting to note further that a second mammoth parasite, the International Tooth Crown Company, which was largely managed by the same individuals who had previously been connected with the Goodyear Dental Vulcanite Company, organized and proceeded to exact ransom from the dental profession. J. N. Crouse, of Chicago, organized the Dental Protective Association to defend the profession. Dentists throughout the nation were in a panic because of the heartless demands made by this grasping monopoly. Members were annoyed and prosecuted for alleged infringement of patents, mostly those on various kinds of artificial crowns and bridgework, the validity of which was never legally established. Heavy tolls were assessed and paid, although a few dentists refused to pay. As late as 1900, this parasite company commenced about fifty lawsuits against dentists, all east of Chicago. In 1904, the president of the Dental Protective Association, Dr. Crouse, wrote: "We must here pause to compliment the members who did act thus loyally and allow this question to be finally settled, as it has been, in the Supreme Court of the United States,"—a notable victory for the Dental Protective Association which, by the way, still exists.

The American Dental Association and the Southern Dental Association continued to function separately until, at an annual meeting of each of these associations at Old Point Comfort, Va., in August, 1897, the following resolution was adopted: "Resolved that the members of the American Dental Association and the members of the South-

ern Dental Association do hereby organize themselves into a body to be known and styled the National Dental Association." Thus united, the leading dental organizations in America were continued under that name, the National Dental Association.

A most important development in the National Dental Association came about through the Illinois State Dental Society. One of its outstanding members, Arthur D. Black, developed what is known as the "Illinois Plan" which led to the reorganization of the state society and later of the National Dental Association. In 1904, the Illinois State Dental Society appointed a committee on reorganization, the members being Dr. Black, chairman, A. H. Peck and I. The membership of the society at that time comprised 274 dentists. The 1905 report of this committee showed that, during the year in which it had functioned, a complete reorganization of the society had been accomplished, with a paid-up membership of 1,196. In addition, a revised constitution and by-laws had been prepared in blank for the thirty-one component societies of the state that had been organized. A monthly bulletin was issued by the state society and a complete card index made, listing every dentist in the state. During that year, about 20,000 pieces of mail were sent out by the committee. The annual dues were lowered from $5 to $2, and notwithstanding the expenses incurred by the reorganization, the treasury showed a net gain of over $700 for the year.

The Illinois Plan attracted the attention of other state societies, and each year several reorganized on a like scale. During the succeeding eight years, no less than fifteen states reorganized their societies. This prepared the way for the reorganization of the National Dental Association, which was accomplished at Kansas City, Mo., in 1913, and resulted in an increase in the membership from about 800 to 12,494. Homer C. Brown was the first President after the reorganization, and Otto U. King, the first General Secretary.

Each succeeding year, more state societies adopted the Illinois Plan and joined the National Dental Association. In 1922, at the Los Angeles meeting, this national organization, through reincorporation, accepted a new charter, issued under the laws of the State of Illinois, The name was again changed, this time to the original one, the American Dental Association, and, under this name, the Association has grown now to an active membership of 32,500.

In addition to the monthly editions of the JOURNAL OF THE AMERICAN DENTAL ASSOCIATION, twelve, additional major activities are carried on by the Association. These activities are summarized in "The American Dental Association, What It Has Done, What It Is Doing," as follows:

1. Bureau of Public Relations.

Offers suggestions and counsel in the promotion of state and community dental health programs.

Supplies educational material, such as reprints, lectures, talks, posters, slides, films, etc., to dentists, hygienists, teachers, nurses, and other public health workers.

Gives advice and assistance in developing talks and lectures pertaining to dental hygiene for various types of audiences.

2. Library Bureau.

Circulates dental books and package libraries to members.

Compiles these package libraries, which are a collection of periodical clippings, reprints, etc., on certain phases of dentistry; over 200 phases are covered.

3. Bureau of Chemistry.

Investigates dental remedies.

Furnishes chemical analyses of "secret" formulae.

Answers inquiries relative to dental remedies.

4. Council on Dental Therapeutics.

Passes upon the therapeutic claims of proprietary remedies.

Publishes reports of findings in THE JOURNAL.

Has printed a compilation of "Accepted Dental Remedies" in book form.

5. Judicial Council.

Interprets and enforces the code of ethics.

Prevents detrimental practices.

Receives and decides questions of ethics.

6. Dental Educational Council.

Establishes standards in dental colleges.

Inspects the facilities of dental colleges.

Rates and classifies dental institutions.

7. Committee on Dental Indexing.

Collects dental literature.

Classifies and indexes articles pertaining to dentistry.

Publishes indexes of dental literature.

8. Committee on Dental Legislation and Correlation.

Keeps in contact with proposed legislation affecting dentistry.

Presents pertinent facts to Congressional committees.

Secures favorable legislation for dentistry.

9. Relief Commission.

Receives, records, and investigates applications for relief.

Co-operates with state or local organizations for thorough investigation of applicants.

Approves or disapproves requests and determines the amount of payments.

10. Research Commission.

Receives applications for financial aid in research pertaining to dentistry.

Passes on the relative merits of the application as to its problem, facilities for research, and the worthiness of the applicant.

Awards grants to promote research.

11. Committee on Organization and Membership.

Develops plans for increasing the membership of the Association.

Stimulates educational campaigns emphasizing the value of membership in the American Dental Association.

Assists constituent societies in securing new members.

12. Committee on Group Insurance.

Arranges for insurance at low cost.

Reflects direct benefit to members through these low rates.

Provides the advantages of protection and security.

These bureaus, councils, committees and commissions, and others not mentioned here, are vital, active, efficient organizations, doing commendable work and rendering valuable service. They furnish direct benefits which are available to all members of the Association and which are the result of efforts to render the Association more helpful to its members.

It is every member's duty to consider what the American Dental Association is doing, that he may appreciate the benefits to be received and also may realize the need of his hearty cooperation in helping the Association to accomplish desirable results. Theodore Roosevelt once said, "Every man owes some of his time to the advancement of his profession."

In this brief résumé, I have not been able even to mention many scores of names of outstanding dentists and their remarkable achievements. I have not touched on the great advance in dental literature, dental education and dental legislation. Suffice it to say that these have kept pace with, and are the outgrowth of, dental organization, and, for the most part, the men who were and are prominent in the promotion of our great Association were and are the men who have contributed to the advancement of dentistry in scientific and educational fields, in dental literature and in dental legislation.

We can justly be proud of the phenomenal past record of organized dentistry. Similar professional advancement could not possibly have been attained without organization. Today, you and

I, as a result of this organization, are the favored recipients of a beneficent heritage, which it is our duty to guard and carefully direct.

The members of the American Dental Association, therefore, have a great responsibility. We must be alert and watchful and must study carefully the many problems that constantly come up for consideration.

The Association is at present engaged in maintaining a constructive program and is, I believe, making commendable progress, but it is also beset with problems, some of which appear to be dark and ominous clouds, which, if not dispelled by the sunlight of intelligence and honest effort, will surely develop into a "whirlwind" that will sweep away the very foundation and ideals upon which our profession is founded. I do not desire to be an alarmist, but never has organized dentistry, in my opinion, faced a more serious problem than one now confronting it, a problem which, if not properly solved, may blight the ideals of our profession and prevent its healthy and vigorous growth. This problem and menace is panel dentistry or state, insurance, corporation or contract dentistry under political or lay control. This menace is especially acute when the dominating control is held by groups whose prime motive and interest is to secure contracts from which to make profits rather than to render honest and efficient service.

It is necessary, therefore, that the searchlight of intelligent criticism be directed on the recent reports, both majority and minority, of the Committee on the Costs of Medical Care, the result of five years of exhaustive research, which were delivered before the National Conference on the Costs of Medical Care at the New York Academy of Medicine, Nov. 29, 1932, and also on the second minority report made by the dentist members of this committee, who did not fully agree with either of the others. Press dispatches pronounce the majority report of this committee to be "revolutionary in that it advocates extension of the hospital center idea with the use of insurance and taxation to place costs on a group payment basis." It is further stated that "its release has stirred the beginnings of a controversy which bids fair to rock the medical world." The *Journal of the American Medical Association* of Dec. 3, 1932, carried an editorial entitled, "The Committee on the Costs of Medical Care," which merits careful reading and study. Editorials on the same subject in THE JOURNAL also deserve special study.

The American Dental Association took an active part in the study of the costs of medical care by furnishing delegates and by generously contributing financial aid, although the committee made no adequate study of group practice as related to dentistry and presented no facts or figures that warrant definite conclusions on the subject of dentistry.

It is evident that none of the groups that developed in the Committee on the Costs of Medical Care, i. e., the majority group, the first minority group and the second minority group, made a careful analysis of the differences existing between the practice of medicine and the practice of dentistry in relation to costs to the patient. None of these groups took cognizance of the fact that dentistry as established in the United States and Canada differs in several fundamental respects from dentistry in Europe and differs also from the practice of medicine, especially in regard to the costs of these essential and necessary health services to the people whose incomes are in the so-called "lower brackets." Let us consider

for a moment a few of the outstanding of these differences:

In the United States and Canada, dentists must be graduated from dental college and licensed to practice. In Europe, dental practitioners consist of two classes, doctors of medicine and dental technicians. The latter do most of the dental work done in Europe, but they have, as a rule, but little dental education.

Medical costs usually begin before birth and continue until death. The cost of adequate medical care is often very heavy during childhood and youth, owing to congenital deformities and accidents and to the contagious diseases and epidemics which so often attack people during these years. The cost of dental care, on the contrary, does not as a rule begin until after the child is several years old, and since the dental needs of young children are as a rule comparatively few, the cost is correspondingly small. In fact, the care of the teeth and associated parts for most children up to the wage earning period need not be expensive and as a rule is not.

When the wage earning period arrives, should an individual be stricken with accident or disease of a serious nature, he is incapacitated and confined to the sick bed. This is costly from the point of loss of time and also because of the cost of medical service, possible surgical operations, hospitalization and special nurses, together with numerous laboratory fees, which may make the cost excessively high. Dental needs, on the contrary, are as a rule cared for in a manner to cause no loss of wages, and adequate dental care to keep the masticatory mechanism efficient and the oral cavity reasonably healthy can be supplied at comparatively little cost. In advanced age, when an individual usually needs medical care to a greater degree, coupled often with nursing and hospital expenses, these costs increase, while those for dental care, as a rule, grow less and less, and, for many individuals, amount to little or nothing.

Thus it is seen that the costs for the services of these two professions are in several respects not comparable and should therefore not be confused.

The editorial in the January, 1933, issue of THE JOURNAL[1] comments on the report of the majority group as follows:

> . . . it must be admitted that its [the committee's] findings are proving a keen disappointment to thinking people.
>
> The expenditure by the committee of nearly a million dollars might have had some justification if there had not been at the very outset of its activities an evident bias in favor of ideas that were subversive of the best interests of the professions and of ultimate harm to the public. . . .
>
> Study the spectacle of the administration of politics in this and other countries today, and see what would happen if political control got its clutch on the administration of professional practice. Not only would the professions be ruined, but the people themselves, under the false promise that they were to be protected, would suffer the most utter neglect, imposition and exploitation at the hands of the politician. Conditions would be unspeakable.

In the ministration of medical and dental aid, in fact in that of the whole group of health services, if the recommendations of the majority group in regard to group practice and group pay should be generally adopted, it is evident that individual private practice would ultimately be almost entirely eliminated and the physician and dentist would have taken away from them independence, initiative and prestige, and their patients would be deprived of the personal contact and confidence which they now enjoy in the professional man of their own selection. Thus would the soul of a profession

1. J. A. D. A., 20:141 (Jan.), 345 (Feb.) 1933.

with a background of hundreds of years be completely destroyed, scientific advancement stultified and the high standards of professional service, built up over these many years, entirely wrecked. The general public whose interest the professions have endeavored to protect would suffer irreparable harm, and the quality of our citizenship deteriorate because of a degenerated health service. These fears are the result of consideration of the unfortunate governmental control of health service in some of the European countries where socialized medicine is dominant.

In anticipation of the adverse report of the majority group, which was made up mostly of men and women who, it is charged, had socialistic tendencies and a bias in favor of the hospital center idea, group practice, group payment, taxation and compulsory insurance, the American Dental Association at its Seventy-fourth Annual Session at Buffalo, N. Y., adopted a report which gave the President of the Association the power to appoint a committee to develop a constructive program to combat the tendency of so-called panel dentistry, and to make a thorough "survey of existing dental health service activities in state, municipal and county public health organizations, and in educational institutions and organizations."

This "Committee for Dental Health Survey" which the President appointed is made up of about thirty outstanding members of our Association under the able chairmanship of C. T. Messner, of Washington, D. C., and is actively engaged at the present time. It is my great privilege to announce that the United States Public Health Service, through the endorsement of Surgeon General Hugh S. Cumming, made this survey possible at this time when it is so evident that a plan should be developed and action begun at once to combat the establishing of group practice and group pay through the medium of general taxation and compulsory health insurance.

The American Dental Association has therefore been alert and is prepared to fight all the unjust and unAmerican propaganda that is undermining American principles. Our great Association through its active and efficient Committee on Legislation and Correlation and the Committee on Dental Health Survey, with the cooperation of the United States Public Health Service, will do everything possible to protect and conserve the best interests of the people. The Committee on Legislation and Correlation has not only been active in fostering constructive national legislation and combating that which would be detrimental to the common good, but it has also stood ready to assist and has assisted our constituent societies in furthering new protective legislation for the people and the dental profession.

Most dental legislation is purely a state problem. Each state must guard its own institutions by enacting sound laws and enforcing them. In a time like this, when economic conditions are particularly distressing, many noxious and dangerous bills are introduced in state legislatures by groups that have no other motive than selfish ones. In California, I have been told, thirty-one bills involving our profession were presented before the present legislature, and twenty-nine of these were introduced by interests outside organized dentistry. In Illinois, there is now in our legislature a bill for legalizing the making of artificial dentures for patients directly by dental technicians. This would tend to eliminate the dentist entirely from this service, and make legal the vicious practice of mail order dentistry which is in reality already in operation. The organized profession of Illinois, I

am glad to report, is doing its utmost to prevent the passage of this bill, and, in addition, has presented a bill to amend the present dental law in a number of important respects. The most outstanding of these is a new definition of the practice of dentistry, which will prevent the practice of dentistry by corporations and will prohibit unethical advertising by dentists. Maryland has recently enacted a law embodying these important provisions, as have also Wisconsin and Ohio, and other states have similiar bills pending in their legislatures.

Another important action taken by our Association is referred to in an editorial in THE JOURNAL[2] entitled "A Tie-Up with the United States Public Health in a Matter of Dental Educational Publicity." The editorial states: "This tie-up between an important governmental agency and our own association is of the utmost importance and will result in great benefit not only to those immediately concerned but in a larger and more utilitarian sense to the public at large whose welfare, after all, is the prime incentive in any effort of this nature." Again must the Surgeon General of the U. S. Public Health Service, Dr. Cumming, be thanked most sincerely for his cordial support of this activity and his offer through the United States Public Health Service to work *with* the American Dental Association in developing a nation-wide educational campaign. The committee headed by C. Willard Camalier, of Washington, D. C., is working diligently and will present a report at the next meeting of the House of Delegates, in August.

The Research Commission, under the leadership of Thomas B. Hartzell, is directing some very valuable work for the profession, the most outstanding of which, to the best of my knowledge, is being carried on in the Bureau of Standards and the National Research Institute at Washington.

It is my belief that one of the most important things that can be done for the membership of the American Dental Association is to stimulate interest in dental research. With many others, I believe that it will be necessary to build up a background of genuine and worthwhile scientific research before the dental profession will receive the full recognition that it has been seeking from other scientific professions and from research workers in other fields of science. Therefore, it is planned, as soon as possible, to devote more attention to this field by the publication of a journal of dental research.

Since March 1 of this year, the editorial department of our Association has been strengthened by the addition of an associate editor, Newton G. Thomas, of Chicago, a man enjoying a most excellent reputation and possessing distinguished ability in several fields of endeavor, particularly as a teacher, writer and research worker. The Committee on Journalism, headed by George B. Winter, of St. Louis, Mo., is at present working on plans either to secure or develop a separate research journal or to increase the number of issues of THE JOURNAL so that three or four numbers each year may be devoted to dental research and allied activities. In addition, the Committee on Journalism is considering a plan for the creation of an editorial council of state editors. This plan was presented to the Board of Trustees last February by Rex N. Douglas, of Elkhart, Ind., the able editor of the *Indiana State Dental Journal,* and promises to be of great value to the Association, especially when urgent and concerted action is needed, by co-

2. J. A. D. A., 20: 524 (March) 1933.

ordinating the editorial efforts of our constituent societies.

There is no more important activity in the American Dental Association, outside of our JOURNAL, than the Bureau of Public Relations, for through it our principal contact is made with the general public. This Bureau is headed by George H. Wandel. In addition to the various activities previously enumerated under this Bureau, it is at present also endeavoring to interest school book publishing companies to introduce into the textbooks for our schools practical lessons on the care of the mouth and teeth; which, if successful, will open a new line of approach to securing the betterment of oral and general health conditions, a movement with which I am fully in accord. In my address as president before the Illinois State Dental Society in 1920, I called attention to such opportunity for instructing children in oral and dental hygiene.

Another valuable branch of the service rendered to the members of our association is the Library Bureau, under the supervision of Mrs. Josephine P. Hunt, a competent librarian. Our library contains approximately 3,000 volumes, including textbooks, bound volumes of magazines, dictionaries and other reference books. Package libraries are forwarded on request to members by mail for the small rental fee of 50 cents. A package library is a collection of clippings, reprints, and excerpts on some very specialized phase of dentistry. The average package library contains about thirty articles. Packages on approximately 300 distinct phases of dentistry have now been compiled. Each year, many hundreds of letters requesting information regarding books on various subjects, dates of publication of articles, addresses of authors and other similar inquiries are received and taken care of.

It was my privilege, April 14, 1933, to attend a day's session of a meeting of the Council on Dental Therapeutics, whose chairman is Harold S. Smith. I was deeply impressed by the work of this Council and in particular by the sincere cooperation of the nondental members who so generously give their time and earnest, honest efforts *gratis* to the cause of humanity, by assisting in sorting out those dental therapeutic remedies, dentifrices and mouth lotions which do not measure up to the requirements prescribed by the Council. The American Dental Association is indebted to these men for the time, effort and advice which they give to the cause of science in our behalf; they merit our sincere appreciation and thanks.

May 26 and 27, 1933, the National Board of Dental Examiners held its first examinations. Examinations covering the first two years of dental college work, known as the junior examination, were conducted in Minneapolis, Pittsburgh, Iowa City and Chicago. Eighty-two applicants qualified for and took the test. I was privileged to be present at the one held in Chicago, and am pleased to report that I was deeply impressed with the fairness of the rules governing the examination and the precautions observed by those in charge to deal justly and fairly with each student.

It is understood, of course, that the National Board of Dental Examiners does not and cannot exercise national jurisdiction, since each state is sovereign in the matter of issuing licenses; but if this board continues to conduct its examinations on the same high scholastic and ethical plane, it will come to receive the recognition of a large majority of the state boards of the nation, and also of the Army, Navy, the United States Veterans

Bureau and United States Public Health Service. This examination is the first step toward securing one of the ends long sought by the profession, namely, a means for reciprocity between states the dental boards of which will recognize the examinations held and the certificates issued by the National Board of Dental Examiners. The medical profession has had a similar national board for several years, and at this time forty-two of the forty-eight states recognize the examinations issued by it. No good reason exists for preventing the National Dental Board from making a similar or even better record.

I should in justice comment on several other of the outstanding activities of our Association, such as the Judicial Council, the Committee on Dental Education, the Committee on Dental Health Education, the Committee on Dental Index, the Relief Commissioners, the Committee on Dental Relief Fund and numerous other standing and special committees which have rendered excellent service to our profession, but time prevents my doing so.

I do desire in particular to call your attention to a committee which was created by the House of Delegates at the Buffalo meeting and which, through cooperation with similar committees in the constituent societies, supplies the life blood of our Association. This is the Committee on Organization and Membership, headed by Albert R. Ross, of Indiana. It was my privilege to write an article, entitled the "Indiana Plan," which was published, I believe, in every state dental journal or bulletin in the nation. In order for constituent societies of the American Dental Association to participate in the working of this plan, it is necessary, as your officers probably know, first to give formal endorsement of the plan by society action; secondly, to provide, either by a standing resolution or amendments to your constitution and by-laws, for cancellation for a limited time of membership fees and remission of annual dues to initially licensed dental graduates, and, thirdly, to provide for the attendance of representatives of your society at the Conference of State Society Officers to be held in Chicago next August. It is necessary that loyal support be given to this committee and its associates in state societies. The American Dental Association, through action of its Board of Trustees last February, decided to supply dental students now in our colleges with THE JOURNAL at the reduced price of $1.00 a year.

To assist further this membership drive, the Committee on Group Insurance, headed by Fred A. Richmond, has obtained and is submitting an attractive insurance rate especially to the younger members of our profession. I understand that, after July 1, 1933, on a limit of $3,000 of insurance, the rate per thousand up to 31 years of age will be about $6.00; up to 41, the rate will be about $8.00; up to 51, about $10.50, and above 51, about $16.30. This should provide an incentive for membership, especially to the younger men, and the rate for those above the age of 51 is decidedly less than is ordinary life insurance in old line companies. There is no more fundamental task before us today than to inspire a desire for membership in dentists not affiliated with us and to secure every eligible dentist as a member of the American Dental Association. This is an especially important task for our constituent societies, for only through new blood can our organization live; only through the concerted efforts of ethical dentists everywhere can the interests of

our profession be maintained and its goal, efficient, honest service to the people, be achieved.

Before closing, permit me to speak briefly of the supreme achievement of the year, the program which has been prepared by the joint program committee for the joint meeting of the American Dental Association and the Chicago Centennial Dental Congress, which will convene at the Stevens Hotel in Chicago, Aug. 7-12, 1933. The official preliminary program for this great meeting has been mailed to more than 75,000 dentists, and will reach every part of the civilized world. This will without question be the largest and most important dental meeting ever held. The educational, historic and scientific exhibit in the Hall of Science at the Century of Progress Exposition is a masterful portrayal of dentistry's phenomenal advancement as a branch of health service, an advancement based, to the greatest degree, on organization and research.

Chicago invites the dental world to visit her this summer, to enjoy her hospitality, her Century of Progress Exposition and the Joint Meeting of the Chicago Centennial Dental Congress and the Amerian Dental Association, the Diamond Jubilee of the latter organization which we will at that time celebrate. I hope that it will be my pleasure to welcome each one of you personally, August 7, in my home city, Chicago.

FACTORS IN THE ETIOLOGY AND ARREST OF DENTAL CARIES*

By RALPH HOWARD BRODSKY, D.M.D., New York City

IN the field of preventive medicine, tremendous advances have been made during the past fifty years, and mankind has utilized the beneficial results quite advantageously. There is one disease, perhaps the most common of all human diseases, which is still rampant throughout the world. This disease is known as dental caries.

There has been a considerable amount of research in all quarters of the earth in an effort to find a means of preventing dental decay. Laboratory animals, such as guinea pigs, rats, rabbits, dogs and monkeys, have been studied extensively, and sometimes with results which seem to be significant. However, a guinea pig is not a human being, and there remains the question as to whether the oral results manifested in these laboratory animals are sufficiently similar to conditions in the human being to permit one to draw definite conclusions. On the other hand, we cannot place the human being in a cage for study and have a complete con-

*Work done in collaboration with Oscar M. Schloss, M.D., and Ludwig Schoenthal, M.D.

*From the Department of Pediatrics, Cornell University Medical College, the New York Nursery and Child's Hospital and the Heckscher Foundation Dental Clinics.

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventy-Fourth Annual Session of the American Dental Association, Buffalo, N. Y., Sept. 15, 1932.

trol of our experiments. Therefore, we must recognize certain variables in this form of study.

Among the early investigators might be included Miller,[1] Black[2] and Williams,[3] who concluded that the teeth were practically inorganic entities which, once formed, could not be appreciably affected by systemic conditions, and, hence, the etiologic factors in caries of the teeth were of purely local origin. More recently, the results of investigations in this subject by Mellanby,[4] of England, Walkhof,[5] of Germany and the Toverud,[6] of Norway, and, in this country, by Howe,[7] Marshall,[8] McCollum,[9] Eddy[10] and others, through studies in dietetic control, stressed the relationship of dietary conditions to structural changes or

Name gmith,Aaron Age 9-15-29. 12yr.3mo.

	9-15-29.	9-20-30.	
Weight	85	72.5	Color W
Height	55.13	57.8	Sex M
			Nationality Amer.

Group Control-Viosterol.

Physical Exam. Pale child,distended abdomen, enlargment of cerv:lymph nodes,
Radiograph of Bones chronic otitis media.

Neg.

Habits Reg.

Temperament Quiet

Home Conditions Good. Cooperative.

Illness During Observation Chronic otitis media

Child Attending Camp etc. 2 weeks 1930.
2 weeks 1931.

Blood Chemistry	Ca.	Protein	Phos.
	10.07	7.36	5.00
	8.77	7.08	5.42
Diet	9.63	7.09	4.36

Milk 2-3gl. daily.Eggs 3-4 weekly.
Fruit 2-3 d. Meat d. Veg. 3-4 w.
Butter loz.d. Cake d. Candy 1-2cts.d.
Poor appetite.

15 drops viosterol BID.

Fig. 1.—Final condensed chart.

1. Miller, W. D.: Micro-Organisms of Human Mouth, Philadelphia: S. S. White Dental Mfg. Co., 1890.

2. Black, G. V.: Dental Caries and Relation to Germ Theory of Disease, Am. J. D. Sc., 1884-1885.

3. Williams, J. L.: Structural Changes in Human Enamel, D. Cosmos., 40:505 (July) 1898.

4. Mellanby, May: Influence of Diet on Structure of Teeth, Physiol. Rev. 8:545 (Oct.) 1928; Structure of Human Teeth, Brit. D. J., 48:737 (July) 1927.

5. Walkhof, Otto: Die Vitamine in ihrer Bedeutung für die Entwicklung, Struktur und Widerstandsfähigkeit der Zähne gegen Erkrankungen, Berlin: H. Meusser, 1929, p. 32.

6. Toverud, K. U., and Toverud, Guttorm: Studies on Mineral Metabolism During Pregnancy and Its Bearing on Disposition to Rickets and Dental Caries, Acta Paediat. (supp. 2), 12:1-116, 1931.

7. Howe, P. R.: Decalcification of Teeth and Bones and Regeneration of Bone Through Diet, J.A.M.A., 79:1565 (Nov. 4) 1922.

8. Marshall, J. A.: Changes in Tooth Structure Resulting from Deficient Diets, J.A.M.A., 81:665 (Jan. 20) 1923.

9. McCollum, E. V., et al.: Relation of Nutrition to Tooth Development and Tooth Preservation, Bull. Johns Hopkins Hosp., 33: 202 (June) 1922.

10. Eddy, W. H.: Dietary Factors Concerned in Building and Maintenance of Teeth, J.D. Res., 11:349 (June) 1931.

defects in the teeth and bones. Mellanby found that caries could be arrested by supplementing the diet with vitamin D obtained either in cod liver oil or irradiated ergosterol. Boyd and Drain,[11] Bunting,[12] Davis[13] and others obtained equally interesting results by means of employing well-balanced diets. Hanke[14] stressed the use of large quantities of vitamin C in the dietary in the form of citrus fruits, particularly oranges and lemons. Others stress the calcium-phosphorus content and, more recently, there have been discussions on vitamins A and B. Bödecker[15] and Howe have conclusively demonstrated that fluids may circulate from the pulp through the dentin and enamel. Thus, we can conceive of the possibility of metabolism occurring in a tooth after it has already fully erupted.

The development of the deciduous teeth begins about the sixth week of fetal life. The dental lamina begins to develop enlargements along the free border and, toward the end of the fourth month, the deciduous teeth are in the process of

Oral Classification	C					
Oral Hygiene	Abund. plaque	Sl. pl.	Sl. pl.			
No. of Deciduous Teeth	Original	Extractions		Remaining	Cavities	Fillings
	-	-		-	-	-
No. of Permanent Teeth	23	-		24	12	-
Bacteriology						
Salivary Reaction	6.8					
Oral Radiographs	9-15-29.	3-15-30.	9-20-30.			
Number of New Cavities	-					
" " " Pits	-					
" " " Slight Pits	1					
" " " Potential Caries	-					
Decalcification Changes	-					
Parents Classification Mother	Russian (1+)					
Father	Amer. (3)					

Generalized hypoplasia
Serrated anteriors.
Superior right cuspid impaction

Fig. 2.—Final condensed chart, reverse side.

calcification (from the enamel toward the pulp). The first permanent molar papilla presents itself between the fourth and fifth fetal month, and the anterior teeth about the sixth month; while the bicuspid papillae appear during the seventh and eighth months of fetal life, so that, at birth, there are approximately forty-four teeth in the various processes

11. Boyd, J. D.: Drain, C. L., and Nelson, M. V.: Dietary Control of Dental Caries, Am. J. Dis. Child., 38:721 (Oct.) 1929.

12. Bunting, R. W., et al.: Problem of Dental Caries, Am. J. Dis. Child., 40:536 (Sept.) 1930.

13. Davis, S. L.: Nutritional Procedure for Arresting Caries. Report of Cases, J.A.D.A., 17:335 (Feb.) 1930.

14. Hanke, M. T.: Relation of Diet to General Health and Particularly to Inflammation of Oral Tissues and Dental Caries, J.A.D.A., 17:957 (June) 1930.

15. Bödecker, C. F.: Nutrition of Dental Tissues, Am. J. Dis. Child., 43:416 (Feb.) 1932.

of development in the jaws. The deciduous teeth are in varying stages of calcification, but the dentin and enamel of the permanent tooth buds apparently do not form until some time after birth. It is therefore obvious that conditions influencing the parent and secondarily involving the fetus will have their greatest manifestations in the deciduous dentition, although the forming permanent tooth buds may be affected. Included among these conditions may be mentioned syphilis, tuberculosis, malnutrition and many other systemic diseases. The permanent dentition is more likely to be disturbed by conditions such as the exanthematous diseases, rickets and other deficiency diseases occurring during the first few years of extra-uterine life.

In consideration of the various suggested forms of therapy for the prevention of dental caries and the fact that there is no universally recognized agreement as to correct procedure, an investigation was undertaken with the purpose of answering certain fundamental questions. These questions can be summarized as follows:

1. What rôle do any of the following dietetic constituents or their combinations play in the prevention or arrest of dental caries: viosterol, abundance of vitamin C, one quart of milk daily and quartz light irradiation of the body?

2. Can the blood composition (chemical) be controlled by dietetic means and is there any definite connection between the calcium and phosphorus level of the blood serum and the development of dental caries?

3. How does candy intake influence caries?

4. Do conditions, such as breast and bottle feeding in infancy and the diseases of early childhood, such as rickets, the exanthemas and gastro-intestinal disturbances, manifest any direct bearing on dental caries?

5. Do diseases of later childhood, the temperaments of children and growth and development exert any definite influence on the decay of teeth?

6. Is there any definite relationship of the parents' teeth to those of their offspring?

7. What is the significance of such conditions as oral hygiene, the salivary reactions and the presence or absence of acid-producing organisms in the mouth as associated with caries?

8. Is there a definite connection between faulty tooth structure and development of dental caries in children, and what are the causes of the enamel hypoplasia?

Fig. 3.—Right: No evidence of caries. Left: Caries on distal aspect of central and mesial surface of lateral incisors (film taken one year later than that shown on right). This form of cavity was difficult to detect clinically.

MODE OF PROCEDURE

Our work had its inception in the fall of 1929. The majority of the children were patients of the dental clinics of the Heckscher Foundation, the remainder having first been seen in the outpatient department of the New York Nursery and Child's Hospital. Ninety-two per cent were American born children, and Puerto Ricans constituted the majority

of those who were foreign born; 90 per per cent were white, while 10 per cent were colored; 48 per cent were male and 52 per cent, female. Most of the children belonged to the poorer stratum. The ages ranged between 4 and 16 at the beginning of the study. The children, for the most part, attended the public schools, and lived not in institutions but under ordinary home conditions.

No treatments were instituted until the children had been examined, charted and grouped, a full series of oral roentgenographic examinations had been made and a specimen of blood was withdrawn in order to determine the calcium-phosphorus and protein content of the serum. This was done after the purpose of the work was explained and the consent of the parent obtained. Some of the children had had dental treatment previous to our first examination, but many of them had never been treated by a dentist. Each child had a physical examination, and a complete history was taken at the time of obtaining the parent's consent. The physical examination was repeated every time the child returned for dental charting and reexamination roentgenographically. At this time, the history, diets and the diseases in the interval were again checked. The weight and height of each child were determined during these examinations. Fifty-two per cent of the children were sent to camp during the summer for a period averaging two weeks.

Our work included the study of approximately 600 children. In this report, we are limiting ourselves to only those children (319) for whom we have at least an adequate full series roentgenographic examination at the first and final chartings, for we are convinced that a report on this subject cannot be accurate unless there is this evidence to substantiate and augment the clinical observations.

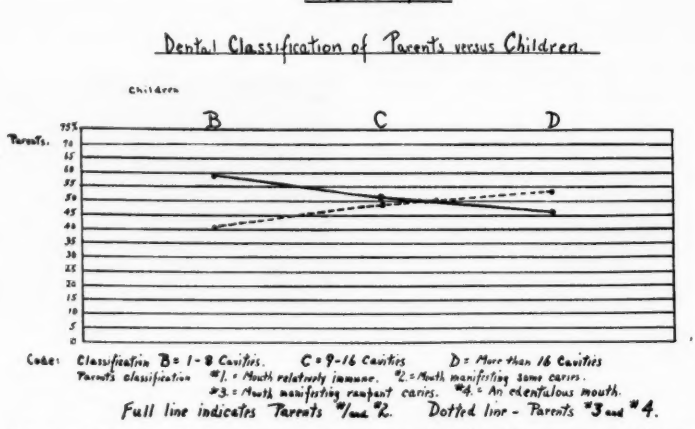
Heredity.
Dental Classification of Parents versus Children.
Children
B
C
D
Parents.
Code: Classification B = 1-8 Cavities. C = 9-16 Cavities D = More than 16 Cavities
Parents classification #1. = Mouth relatively immune. #2. = Mouth manifesting some caries.
#3. = Mouth manifesting rampant caries. #4. = An edentulous mouth.
Full line indicates Parents #1 and #2. Dotted line - Parents #3 and #4.

Fig. 4.—Graph on which mouths of parents are plotted against those of children.

Contact with the parents was established through our full-time social worker, who studied the economic condition of the family, the home conditions and the cooperation of the parents and children. Special diet slips were prepared on which were enumerated the

various foodstuffs consumed. Each child was required to fill in the quantity and type of food eaten daily, candy being included. On the reverse side were notations concerning the habits of the child, such as bedtime, hours spent in school, at play and in sleep, indoor and outdoor activity and bowel movement. At the end of each week, these charts were collected and tabulated. For the children who were too young to execute the charts, their parents or older members of their families volunteered this service. The least once daily in addition to sufficient quantities of cereal, bread, potatoes, spaghetti, rice, cheese, and other foodstuffs. Those children (forty) who were in very poor economic circumstances received one quart of grade "A" milk daily. Likewise, where necessary, 1 orange was given daily to supplement the diet. In a second group, viosterol 100 D. was added to the diet. Children from 4 to 6 years old received 10 drops daily; those from 6 to 12 years received 15 drops daily, and those above 12 years received 20 drops daily.

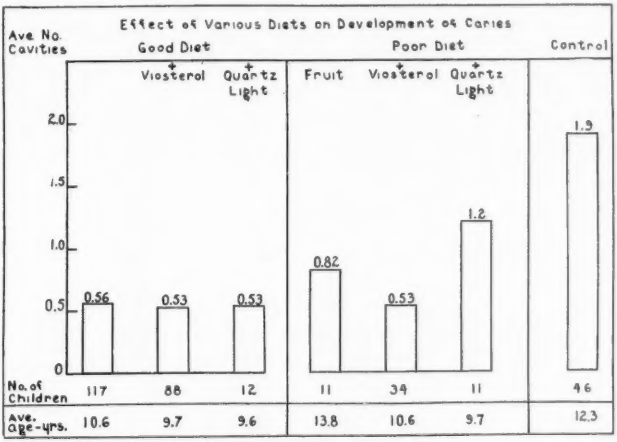

Fig. 5.—Chart showing the effect of various diets on development of caries.

significant facts were transferred to specially prepared condensed charts. (Figs. 1-2.)

After approximately 200 children had been selected, the preliminary examinations having been made, they were divided into different groups of about equal age distribution and their diets were supplemented according to our plans. In the first group, a diet was given which we considered well balanced: 3-4 glasses of milk daily, 1 piece of fruit daily, 1 serving of fresh vegetable daily, 1 ounce of butter daily, and meat, eggs or fish at Viosterol was given for periods of six weeks, withheld for two weeks and then repeated throughout the period of observation, except during the months of July and August, when no viosterol was administered at all. In the fall of 1930, viosterol 100 D. was changed to viosterol 250 D. The quantity of viosterol for this group was not increased.

In a third group of children, 3 oranges were supplied by us daily, and the children were requested not only to drink the juice but also to eat the pulp. A fourth group received ultraviolet radia-

tion in the form of quartz-light therapy (Alpine lamp) twice weekly, commencing with two-minute exposures at a distance of 36 inches, and gradually increasing so that the treatments culminated with a maximum exposure of thirty minutes. This course of treatments consumed a period of six weeks and was repeated three times annually. A fifth group was considered as a control. One tablet of calcium lactate 0.5 gm. was given twice weekly merely for psychologic purposes. The poorly balanced diets were unchanged.

the same general treatment as those of the other groups, but their poor diets were unchanged and no blood determinations were made. This was another control group.

Final Dietetic Classifications.—During the course of the observations, most of the parents were very cooperative. Radio and the many other educational agencies could not be banned, and our social worker, when questioned by the parents, could not but furnish some information in relation to diet, which resulted, unfortunately, in a change in

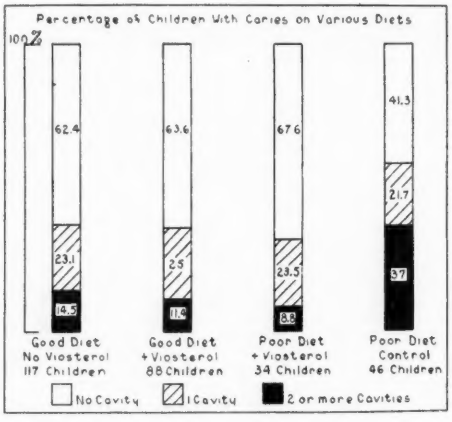

Fig. 6.—Percentage of children who developed no cavities, one cavity and two or more cavities in various diet groups.

A sixth group were examined in the fall of 1930 and children manifesting active caries were selected to be fed viosterol 250 D., receiving larger doses than those in the earlier viosterol groups. Children ranging from 4 to 9 years of age received 20 drops daily, those from 9 to 12 years received 30 drops and those above this age received 40 drops daily. Another group had their diets augmented with three 1.5 gm. tablets of calcium gluconate daily.

An eighth group of children received

some of the diets. Consequently, in our final tabulations, we found a large number of children whom we had originally classified as controls (on poor diets) whose diets had become better. This accounts for the smaller number of controls as contrasted with the good diets. Finally, we classified the groups as follows: 1. Good diets. 2. Good diets and viosterol. 3. Good diets and quartz light. 4. Poor diets plus viosterol. 5. Poor diets plus fruit. 6. Poor diets plus quartz light. 7. Poor diets (control).

Method of Dental Charting.—Each mouth was accurately charted, and recharted at regular intervals. Special forms were printed in order to simplify our work and to give us a simple résumé of the findings. All cavities and fillings were notated as such for both the deciduous and the permanent teeth. The teeth already erupted were counted and the condition of oral hygiene was noted, as likewise were conditions such as decalcification tendencies, the presence of tegrity of the enamel was impaired but not yet broken down. Drawings and charts of the extent and involvement were employed in many instances in order that careful observations could be made at the subsequent chartings. Comparisons were made with the roentgenographic examinations, and where it was observed that cavities were not recognized in the clinical examinations or where cavities became larger, these notations were added to the charts.

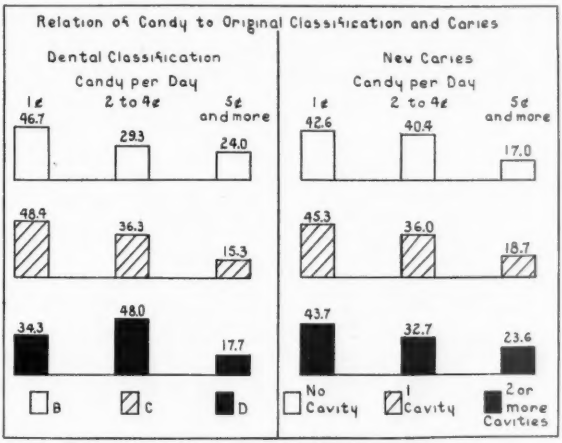

Fig. 7.—Relation of intake of candy to original classification and caries.

anomalies, hypoplasia, impacted teeth, abnormal frenums, brown stain and serrated anterior teeth. The number of cavities, pits, slight pits and potential carious areas was charted. Cavities were noted as mesial, palatal, mesial-occlusal, etc. Pits were considered where a sharp explorer caught definitely, but there was not a definite involvement of the dentin. Slight pits were found where the explorer caught slightly, but where there was no definite break in the enamel. Potential caries was manifested as a condition predisposing to actual caries, such as marked localized decalcification in which the in-

Method of Dental Classifications.—There has not as yet been any generally accepted method of classifying mouths. Bödecker[16] has suggested an index in relation to the varying susceptibility to dental caries, but his method has several significant shortcomings. He registers an extracted or missing tooth as three cavities; hence, charting a mouth after the extraction or exfoliation of a deciduous tooth prior to the eruption of the permanent tooth would constitute three cavities

16. Bödecker, C. F.: Practical Index of Varying Susceptibility to Dental Caries in Man, D. Cosmos, 78:707 (July) 1931.

in a mouth which might otherwise be caries-free. The size and extent of the carious areas differ from pinpoint involvements to extensive deep-seated caries, yet they count alike as one cavity. Elimination of the inferior anterior teeth from the chart is not practical; for many mouths manifest considerable involvement of these teeth, such as mesial, distal and cervical caries; while, in the same mouths, the bicuspids are sometimes found to be intact.

The method that we found most advantageous (although not free from defects) consisted in classifying the mouths by letters A, B, C and D. A constituted a mouth free from fillings or cavities (one child); B manifested from one to eight fillings or cavities (ninety-two children); C, from nine to sixteen fillings or cavities (124 children). Those with more than sixteen cavities or fillings were classified as D mouths (102 children). We considered a cavity a carious involvement of one surface of a tooth. If it involved two surfaces, it became two cavities; if three surfaces, three cavities. Thus, a mesioclusal cavity was counted as two cavities. As the extractions averaged about the same for all groups of children, we did not consider them in this classification. If a tooth had been filled during a period of three months prior to our first examination, this filling was counted as a cavity. The number of teeth in all the groups averaged approximately the same per child. The average age of the children was 11.4, 10.7 and 11.5 years for the B, C and D groups, respectively.

Oral hygiene: For purposes of classification in oral hygiene, the mouths were divided as follows: good, fair, moderate plaque, and abundant plaque or poor. The children were subjected to prophylactic treatments by a full-time hygienist at regular intervals.

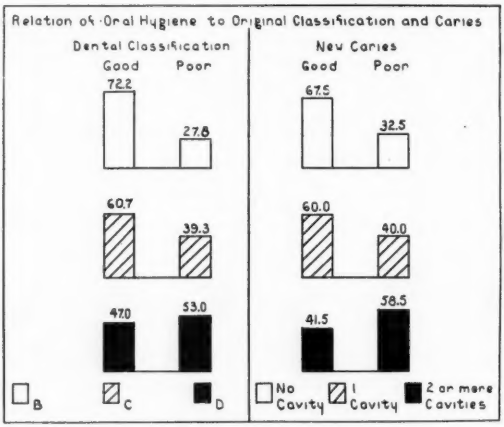

Fig. 8.—Relation of oral hygiene to original classification and caries.

Operative dentistry: No operative dentistry or oral surgical procedures were performed until all charting, roentgenographing and other preliminary examinations had been completed. The treatments were administered to the group children by two full-time and several part-time dentists, who concluded the filling of the teeth as quickly as possible.

Roentgenography: Each child had a

full series oral roentgenographic examination at regular intervals. (Fig. 3.) Sixty children were subjected to roentgenographic examination of the long bones. These children had viosterol added to their diets.

Dental classification of parents: The parents were examined and their mouths classified in a general manner as follows: 1. Mouths with noncarious diathesis. 2. Mouths manifesting slight caries tendencies. 3. Extensive carious involvement. 4. Edentulous mouths. Both the mothers and fathers were charted.

Chemical methods: 1. Serum. Blood for calcium-phosphorus and refractometric index determination was taken between 9 and 11 a.m. The children had their usual breakfast before they left home. For the determination of calcium, a modification of Clark-Collips[17] adaption of the Kramer-Tisdall method was employed. With this method, the values for calcium ranged between 8.5 and 10.5 mg. per hundred cubic centimeters. Duplicate tests were made in nearly all cases. For the determination of inorganic phosphorus, Tisdall's[18] method was used in the great majority of cases. Fiske and Subbarow's[19] method was employed in a few cases. The same method was used for every child. In agreement with Bullock, the range of inorganic phosphorus was found between 4 and 5 mg. per hundred cubic centimeters between the ages of 5 and 15.

2. Saliva. These determinations were made by means of the colorimetric method and were performed immediately after the collection of the saliva.[20] No stimulant was given to produce the salivary flow. The samples were not collected under oil.

Bacteriology of the oral cavity: The bacterial flora was examined before any therapy was instituted. In at least half of the cases, the examination was repeated within a short time, and the results of both tests were considered. This study comprised a group of 109 children. Cultures were taken from the saliva, the surfaces of the teeth and two cavities when caries was present. The swab or explorer was immersed in glucose broth

Table 1.—Relation of Feeding During Infancy to Dental Classification

Breast-Fed Number of Months	Number of Cases	Dental Classification		
		B	C	D
None	42	11	13	18
3–6	30	10	11	9
6–12	110	36	48	26
12 or more	99	26	36	37

p_H 5.0. After two days, the growth was streaked on liver-agar plates p_H 5.8. The colonies were examined microscopically and were transferred to a glucose broth p_H 6.8 after forty-eight hours. After one week's incubation, the p_H of the broth was examined colorimetrically (Cullen). The case was considered positive when any of the tubes from which the organisms were isolated showed a reaction on the acid side of p_H 5.0. This point was chosen rather than p_H 4.0 because it has been shown that decalcification can go on at this acidity if it is maintained over a long period of time.

17. Clark, E. P., and Collip, J. B.: Tisdall Method for Determination of Blood Calcium with Suggested Modification, J. Biol. Chem., 63:461 (March) 1925.

18. Tisdall, F. F.: Rapid Colorimetric Method for Quantitative Determination of Inorganic Phosphorus in Small Amounts of Serum, J. Biol. Chem., 50:329 (Feb.) 1922.

19. Fiske, C. H., and Subbarow, Y.: Colorimetric Determination of Phosphorus, J. Biol. Chem., 66:375 (Dec.) 1925.

20. Stern, A. R.: Hydrogen-Ion Concentration of Normal Resting Saliva in Children and Its Relation to Dental Caries, D. Cosmos, 73:1017 (Oct.) 1931.

RESULTS

For clarification, the results will be divided into the conditions existing prior to our observation period, and the conditions resulting during our observations as related to dental caries.

A. The Effect of Various Conditions as Influencing the Teeth Prior to Our Observation (the Original Classification).—1. Breast feeding and artificial feeding: Data were collected pertinent to breast feeding and bottle feeding during infancy and compared with the children's dental classifications B, C and D. It is apparent from Table 1 that maternal nursing is not an important factor in mitigating the development of dental caries.

2. Diet prior to our observations: An analysis of the diets immediately preceding the period of observation indicates that the larger percentage of children who lacked either fruit, milk or vegetables, belonged to the D group. This result received confirmation from the more detailed data collected during the period of observation.

3. The calcium and phosphorus level of the blood serum: This included 200 children whose calcium-phosphorus and refractive index were examined and compared with the original dental classifications. According to our data, no definite simple relationship existed.

4. Diseases of infancy: Thirty-three children who had infantile rickets with definite clinical signs, such as chicken breast, funnel breast or bowing of the legs, were classified dentally as follows: ten in the B group; ten in the C group and thirteen in the D group. One child who had infantile tetany was given a B classification. Eleven who suffered from severe gastro-intestinal disorders during infancy had a distribution of four B, three C and four D classifications.

5. Diseases of childhood: Of the diseases of childhood such as measles, mumps, chickenpox, pertussis and pneumonia, there was an almost even distribution of the B, C and D cases; i. e., measles, ninety-six B, ninety-nine C and seventy-six D classifications.

6. Heredity: In an effort to consider the hereditary factor by comparing the mouths of the parents with those of their offspring from the point of view of caries, the parent Groups 1 and 2 were combined as a good mouth group and Groups 3 and 4 as a poor mouth group. The parents' mouths were plotted against the children's mouths (B, C, D). Figure 4 indicates that although there is no striking relation, there is some indication that parents who are relatively caries immune are apt to transmit this immunity to their offspring.

7. Temperament: In order to study the association of temperament or the nervous conditions of children and the incidence of dental caries, we divided the children into three groups: Group 1 consisted of 162 quiet children; Group 2 contained fifty-six slightly nervous children, and Group 3 was composed of ninety-six nervous children. We found no difference in the distribution of these children over the B, C and D groups. We recognize certain variables in this form of study.

8. Hypoplasia: In a group of thirty-four children who evinced marked generalized hypoplasia of the enamel, we found the following distribution: one A, eleven B, fourteen C and eight D. This was relatively the same distribution that was found in the total combined groups. We feel, therefore, that faulty structure *per se* does not necessarily lead to the development of dental caries.

B. The Effect of Various Factors on the Development of Caries During the Period of Observation (New Caries).—

1. Diet: The average number of cavities per child according to the different diets received has been calculated. Figure 5 summarizes the results in the various groups studied. The children who received good diets (117) developed approximately half a cavity per child. Eighty-eight children whose good diets were supplemented with viosterol (10-40 drops daily) also manifested half a cavity per child. Twelve children who, in addition to good diets, received quartz light irradiation likewise developed half a cavity per child. In the other groups, thirty-six children whose diets were poor or insufficient, but who received 10-40 drops of viosterol daily, showed an incidence of only half a cavity per child. Eleven children who were irradiated with quartz light and received poor diets developed 1.2 cavities per child. A small group whose diets were augmented with three pieces of fruit daily (chiefly oranges), and another small group which received calcium gluconate also compared favorably with the control group of forty-six children who had poor diets (with no added factor) and who developed 1.96 cavities per child.

It is apparent that when the diet is sufficient, the addition of such factors as viosterol or quartz light is not important, for there is evidently enough vitamin D present, but when a diet is insufficient, its supplementation with viosterol may be of material benefit. Statistical treatment of our results indicates that there is a significant difference between the control group and the good diet groups. The period of observation was thirteen months. A longer observation period of twenty-two months resulted approximately in the same group comparisons.

TABLE 2.—RELATION OF CALCIUM AND PHOSPHORUS TO NEW CARIES

New Cavities		Total Cases	Calcium				Total Cases	Phosphorus			
			Increase		Decrease			Increase		Decrease	
No.	Period of Obs. Mos.		No. Cases	Per Child Mg. Per Cent	No. Cases	Per Child Mg. Per Cent		No. Cases	Per Child Mg. Per Cent	No. Cases	Per Child Mg. Per Cent
None	6	87	40	0.49	47	0.43	121	61	0.48	60	0.47
	12	52	17	0.33	35	0.69	67	15	0.54	52	0.49
1	6	29	16	0.45	13	0.54	47	18	0.48	29	0.48
	12	13	6	0.21	7	0.49	19	7	0.47	12	0.69
2 or more	6	15	11	0.46	4	0.79	24	8	0.54	16	0.63
	12	9	3	0.31	6	0.72	14	8	0.53	6	0.83

In tabulating the children who developed no new cavities (Fig. 6), one cavity and two or more new cavities, we find that, in the two groups receiving good diets (with or without viosterol), the percentage of children with no new cavities is about the same, slightly above 60 per cent. The group which received viosterol plus a poor diet is equally good. In the control group with a poor diet alone, 41 per cent of the children developed no new cavities.

2. Calcium-phosphorus level of the serum: In a series of eighty-seven cases studied in which caries was arrested after

six months, calcium was found increased in forty cases (plus 0.49 mg.) and decreased in forty-seven cases (minus 0.43 mg.). (Table 2.) After twelve months, there was an increase in seventeen cases and a decrease in thirty-five cases. The same variation was found for phosphorus. Our results indicate therefore that there is no simple relation between arrest or progress of caries and increase or decrease of the calcium and phosphorus level of the blood serum.

3. The effect of 1 quart of milk and fruit: Forty-five children who received two or three pieces or more of fruit daily, but who did not receive 1 quart of milk daily developed 0.53 cavities per child. Forty-one children who received 1 quart of milk daily, but not much fruit developed 0.41 cavities per child. Thirty-three children who received both 1 quart of milk and plenty of fruit daily developed 0.36 cavities per child. These results are interesting, but the groups are not large enough to afford any conclusive evidence.

TABLE 3.—SALIVA (p_H) VS. NEW CARIES

Cavities	Saliva p_H			No. Children
	6.6	6.8	7.0	
None	35.7%	47.1%	17.2%	157
1	28.4%	52.7%	18.9%	74
2	44.2%	39.5%	16.3%	43
3 or more	25.8%	58.1%	16.1%	31

4. Effect of candy: It is apparent from our data as illustrated in Figure 7 that the difference between the groups of children who spent 7 cents for candy weekly and those who spent 35 cents weekly does not warrant any conclusions as to the harmful effect of carbohydrate eaten in this form. The control or poor diet group manifested the same distribution as our good diet groups.

5. Diseases during observation: Forty-three of a group of 319 children were confined to their beds or homes for a period of one week or more because of febrile disease. Twenty-six of these children developed no new cavities, eleven developed one new cavity and six developed two or more cavities. Most of these children suffered from infections of the respiratory tract such as grip, bronchitis, pleurisy and pneumonia.

6. Oral hygiene: Figure 8 indicates that although oral hygiene *per se* is not a definite factor in the prevention or causation of dental caries, it may be a significant contributing factor in association with other conditions. We realize that a clean tooth may become carious and an unhygienic mouth may evince no caries.

7. Saliva: In 305 children whose saliva p_H was determined, 104 had a p_H of 6.6; 148, of 6.8, and 53, of 7.0. The data in Table 3 indicate that the salivary p_H is not an important factor in distinguishing a caries-free mouth from that of a carious diathesis.

8. Height and weight: In order to study the relationship of the gain in weight and height to the incidence of new caries, the children were divided into age groups. The average gain in weight and height was calculated, and no definite relation to the development of new caries was found.

9. Bacteriology of the oral cavity: The results indicate that acid-producing organisms were present in all the mouths examined at the beginning of the observation. The incidence of gram-positive acidogenic bacilli was greatest in the mouths with marked caries (96.5 per cent), but they were also found in the mouths which were free from caries. In more than 50 per cent of the children, gram-positive acidogenic bacilli were

found in all parts of the oral cavity. The fact that acid-producing organisms were present in all mouths suggests that their presence does not necessarily lead to the development of dental caries.

10. Hypoplasia: The histogenesis of enamel hypoplasia is still undetermined. (Table 4.) It was of interest to see whether those children who manifested definite hypoplastic conditions of the enamel showed a greater incidence of caries than those whose teeth exhibited no visible structural defects. Our results are quite iconoclastic as compared to those of many investigators. In a group of thirty-four children in whom marked generalized hypoplasia was found, a very low incidence of new caries was found (0.44 cavities per child). The distribution of the thirty-four children over the B, C and D groups was as follows: one A, eleven B, fourteen C and eight D, which was relatively the same as that of the total combined groups. The one child in our entire group who had no cavities evinced marked hypoplasia. We believe, therefore, that faulty structure *per se* does not necessarily lead to the development of caries. Concerning the causation of these hypoplasias, we have observed that of the thirty-four children, during their first few years of life nine had rickets, twenty-eight measles, fourteen pertussis and ten chickenpox, a smaller number manifesting otitis media, mumps, pneumonia, tetany, etc. Unfortunately, we cannot know the severity of attack of these diseases as manifested in these particular children. Further, a large percentage of children in the entire group were subjected to similar diseases at the same ages, and there were no gross manifestations of structural change observable. It is possible that, in severe rachitis, we have a more prolonged effect on the disturbance of calcification, which may account for the manifestation of extensive generalized hypoplasia. In the teeth exhibiting smaller areas of hypoplasia, it is likewise possible that the exanthemas of childhood which may be severe but of not long duration may be causative.

11. Incidence of age in the development of caries: The three age groups were tabulated and the following incidence of new caries was revealed: 4-9 years, 0.73 cavities per child; 9-12 years, 0.44 cavities per child, and 12-16 years, 1.03 cavities per child. (Table 5.) We are of the opinion that the age factor as associated with dental caries is not of great significance during the various periods of childhood.

Table 4.—Enamel Hypoplasia

Number of Children Affected	Oral Classification	No. of Children with			Average Cavities per Child	Duration of Condition
		No Cavities	1 Cavity	2 Cavities		
34	1A 11B 14C 8D	24	5	5	0.44	15.5 months

COMMENT

All investigations on the dietary treatment of dental caries are based on the assumption that it is possible to affect the composition of dentin and enamel of the erupted teeth through changes in the body fluids. It was found that children may develop caries with a relatively low,

normal or even high serum calcium and phosphorus. Hanke and Karshan and co-workers[21] report similar observations in adults. With our dosage of viosterol added to the diet, no change in the level of the two electrolytes was noted. We know that, in rickets, a low calcium and phosphorus level is nearly always increased by the administration of irradiated ergosterol. Studies on the blood serum of older healthy children are not available in the literature, to our knowledge. No unfavorable effects from the use of this drug were observed by us. In a series of sixty children in whom the long bones were roentgenographed, only two manifested any definite increase in calcification. The mechanism of the action of viosterol in moderate dosage is not definitely understood, and a negative blood chemical result does not necessarily exclude an effect of the drug on the teeth. Toxic doses have been shown to produce hypercalcification in the teeth by Weinmann.

It has been suggested (by Broderick[22]) that caries may be due to an acidosis and that a well-balanced diet rich in fruit and vegetables may increase the alkalinity of the blood and the buffer capacity of the saliva. The results of actual determinations of the titratable acidity and p_H of the saliva of persons suffering from caries are contradictory. (Pickerill, Marshall, Clark and Lewis, Ruskin and Entin.) Our own data on the p_H of saliva do not show a positive relationship between caries and the salivary p_H.

Some of our clinical results are in agreement with those found by Boyd and Drain, Bunting, Hanke, Mellanby and others. Our observations were made on children living under ordinary home conditions. This has its advantages and disadvantages. With the cooperation of the parents and the supplementation of the diets with milk and fruit, we have proved that an adjustment of the diets and the arrest of caries are possible even under the poorest conditions. Our good diets contained only the ordinary foodstuffs which should be present in every well-balanced diet. The analysis of the diets previous to our observations shows how unbalanced the diets of most children are. We observed the main deficiencies to be those in milk, fruit and vegetables. Milk is the cheapest source of calcium and

TABLE 5. — INCIDENCE OF NEW CARIES ACCORDING TO AGE GROUPS (ALL DIETS INCLUDED)

Age Years	Number of Children	Short Period (Approximately 13 Months)	Long Period (Approximately 20 Months)
4 to 9	103	(75 cavities in 41 deciduous and 34 permanent teeth) 0.73 cavities per child	(156 cavities in 86 deciduous and 70 permanent teeth) 1.51 cavities per child
9 to 12	86	(38 cavities in 4 deciduous and 34 permanent teeth) 0.44 cavities per child	(79 cavities in 12 deciduous and 67 permanent teeth) 0.92 cavities per child
12 to 16	130	(134 cavities in 134 permanent teeth) 1.03 cavities per child	(244 cavities in 1 deciduous and 243 permanent teeth) 1.87 cavities per child

21. Karshan, M.; Krasnow, F., and Kerzei, L. I.: Study of Blood and Saliva in Relation to Immunity and Susceptibility of Dental Caries, J. D. Res., 11:573 (Aug.) 1931.

22. Broderick, F. W.: Etiology of Dental Caries and Pyorrhea, Brit. D. J., 48:317 (March 15) 1927.

phosphorus found in the natural form, and it seems desirable from the observations made by Sherman and co-workers[23] that the calcium and phosphorus content of a quart of milk should be contained in every child's diet. Certain children, if forced to take 1 quart of milk daily, will not consume any appreciable quantity of the other essential foods. We have observed a number of children who received 2-3 glasses of milk daily, with an otherwise satisfactory diet, in whom caries was arrested. In such children, the addition to the diet of cod liver oil or irradiated ergosterol may be of advantage.

Our results in the groups of children who received viosterol in addition to a small, but the results were encouraging, and we believe that if a child with caries does not take cod liver oil, viosterol can be substituted without harmful results.

In addition to calcium, phosphorus and vitamin D, the necessity of an abundant supply of citrous fruits has been emphasized by Howe, Walkhof and Hanke. Our good diets which contained a minimum of two or three pieces of fruit daily gave similar results to the diets which contained 1 quart of milk without the additional fruit. The children did not receive as large a quantity of fruit as advocated in Hanke's investigations. The number of children in the poor diet group who received three oranges daily is too small to form the basis of conclusions,

TABLE 6.—MANIFESTATION OF NEW CARIES AS COMPARED WITH THE DENTAL GROUPINGS B, C, AND D

	B	C	D
319 cases combined, regardless of dietary or other factors.....	0.47 cavities per child	0.53 cavities per child	1.24 cavities per child

good diet are the same as those obtained among the children who received a good diet without any additional supply of irradiated ergosterol. This indicates that a well-balanced diet contains the necessary quantity of vitamin D to prevent caries. A favorable result was obtained in the group of children whose poor diet was supplemented by the addition of viosterol. Mellanby, in her studies of children on institutional diets to which were added cod liver oil or viosterol, observed similar results. Her pioneer work in the field was based on the observations of animals that were free from structural dental defects if fed a diet rich in vitamin D. Our group of children was relatively but the results were favorable as compared with those of the control group. Despite a sufficient quantity of fruit in the diet, a number of children manifested a gingivitis. Likewise, the group which received calcium gluconate was too small to afford a basis for conclusions, but compared favorably with the control group.

An excess ingestion of refined carbohydrate in the form of candy has been indicated by many investigators as a cause of caries. Our analysis does not reveal any such striking relation between candy and caries. There were several children in our group who expended $1.50 to $2.00 weekly for candy (cheap chocolates and lolly pops) who did not develop caries. We do not believe that small quantities of candy or sugar are harmful as long as they do not prevent

23. Sherman, H. C., and Hawley, E.: Calcium and Phosphorus Metabolism in Childhood, J. Biol. Chem., 53:375 (Aug.) 1922.

the ingestion of the important foodstuffs.

The groups which received quartz light were too small to be considered conclusively, and it is impossible to say from our data why the children who received irradiation of quartz light with a poor diet manifested more extensive caries than those who received viosterol. The dosages of quartz light which were used are considered sufficient to produce healing of rickets in infants. Further work may explain this discrepancy.

McCollum[24] has enumerated all of the known elements in foods which may have some bearing on the development of dental caries. It is impossible at present, in our opinion, to decide exactly which factors are essential to immunity to dental caries. This is not only true qualitatively, but also quantitatively, since it is not known how great the individual requirements for the various known vitamins are. The opinions are not unanimous as to the ability of vitamin D, in addition to a sufficient quantity of calcium and phosphorus, consumed during the prenatal period, to prevent postnatal rickets and caries. (Hess and Abrahamson, Mellanby, etc.) Our observations indicate that children who are breast fed develop the same number of carious areas as those who are bottle fed. The clinical experience of Bloch and A. F. Hess has shown that children who suffer during infancy from vitamin A deficiency (keratomalacia) and vitamin C deficiency (scurvy) develop teeth the condition of which is as good as those of other children. Hess and Abrahamson[25] observed that children who had rickets during infancy (vitamin D deficiency) developed slightly more caries than other children. According to Mackay, children who suffer from rickets show a higher incidence of marked hypoplasia than others. Our own experience reveals a possible connection between severe rickets and marked enamel hypoplasia. A series of children have been observed who had no rickets and who manifested both caries and hypoplasia. The relationship of vitamins to the teeth of human beings is far from being clear, and the results of animal experiments should not be applied indiscriminately to children.

In addition to the deficiency diseases, we have devoted some attention to the influence of other diseases on immunity to caries. We have considered the possible influence of the exanthematous diseases of childhood on the structure of the teeth during their formative period and on the development of caries. There was no striking correlation between these diseases and caries. It appeared that those children who manifested marked hypoplasia indicated in their histories some exanthematous disease during their early childhood. Our data are not sufficient to permit us to draw any definite conclusions, since there was no definite means of determining the severity of the diseases. Constitutional factors such as heredity or race may be of significance in the consideration of this matter.

We have found a slight correlation between the manifestation of caries in the teeth of the parents and in those of their offspring. There is little concrete knowledge pertinent to this subject available in the literature, and it is a matter which should be investigated on a larger scale, utilizing, perhaps, the blood groups of the parents and children.

Further, we have considered the gain in weight and height of the children and the influence of age on the development of

24. McCollum, E. V.: Relationship Between Diet and Dental Caries, J. D. Res., 11: 553 (Aug.) 1931.

25. Hess, A. F., and Abrahamson, H.: Etiology of Dental Caries, D. Cosmos, 73: 849 (Sept.) 1931.

caries. The study of the weight and height in the different groups revealed no significant results. We have found the following incidence of new caries for the age groups: 4-9 years, 0.73 cavities per child; 9-12 years, 0.44 cavities per child; 12-16 years, 1.03 cavities per child. It is our opinion that the manifestation of caries is nearly as marked in younger children as it is in older children. Hence, the age factor is not of great significance during the various periods of childhood.

Up to this point, we have discussed the influence of systemic factors on the teeth. In accordance with our results, oral hygiene plays a rôle in the development of caries; but again these results are far from being absolute. A clean tooth may decay and an unclean tooth may not decay. Our work on acid-producing organisms in the mouths of children immune or susceptible to caries, indicated their presence in all mouths. Hence, it is suggested that the presence of these organisms does not necessarily lead to the development of dental caries.

The question of specific organisms and specific antibodies as associated with immunity to dental caries is a subject which requires further study.

Many children in whom a carious diathesis was manifested originally continued to evince a greater rate of carious development than those with a relative immunity to caries. (Table 6.) The distribution of new cavities in the dental groupings was as follows: combining all diet groups: B, 0.47 cavities per child; C, 0.53 cavities per child; D, 1.24 cavities per child during a one year period. This seems to indicate that our therapeutic measures are not sufficient to suppress entirely the development of caries.

Apropos of the relation of the structure of the teeth and caries, the children with marked hypoplasia manifested a very low incidence of caries (0.44 cavities per child). This is contradictory to most of the conclusions found in the literature and throws doubt on the great stress laid on the importance of structural defects (Mellanby).

It is significant that all of the children in these groups received complete oral roentgenographic examinations at regular intervals. This control of our clinical oral examinations resulted in an appreciable increase in the number of cavities charted. As a result, our findings were considerably more accurate than what they would have been had not roentgenography been employed.

SUMMARY

A group of 319 children, living in the homes of their parents, were observed for a period of approximately thirteen months. During this time, 117 of these children who received a well balanced diet consisting of at least 3 glasses of milk, 1 piece of fresh fruit, 1 portion of fresh vegetables, meat, eggs, or fish and 1 ounce of butter daily in addition to the ordinary foodstuffs developed 0.56 cavities per child. Eighty-eight children who had a similar diet in addition to viosterol (10-40 drops daily according to age) developed 0.52 cavities per child. Thirty-four children who had a poor diet, deficient in any two of the following foodstuffs such as milk, vegetables, fruit and protein and who received viosterol developed 0.53 cavities per child. A control group of forty-five children whose diets were as inadequate as those of the preceding group and who received no added factor developed 1.96 cavities per child. Favorable results were obtained in two additional groups (twenty-three children) which received quartz light irradiation in addition to good or poor diet respectively. A small group (eleven children) receiving fruit in addition to a poor

diet compared favorably with the control group.

The study of the serum calcium and phosphorus indicated no relationship between the level of calcium and phosphorus and the development or arrest of dental carries either before or after dietary treatment. No definite explanation could be determined for the mechanism of diet in the arrest of caries.

The possible influence of a variety of other factors such as salivary reactions, ingestion of candy, breast feeding, diseases during childhood, heredity, the influence of age, gain in height and weight and development have been investigated and have given some additional information without revealing any striking relation. In this group of children, the mouth hygiene indicated a positive correlation with the development of caries.

Thirty-four children with marked hypoplastic conditions (thirty-one of whom were on a good diet) developed 0.44 cavities per child. This throws doubt on the considerable stress attributed to the importance of structural defects in teeth as predisposing to dental caries.

TISSUE TOLERANCE TO FOREIGN MATERIALS*

By C. MERLE DIXON, D.D.S., and U. GARFIELD RICKERT, D.D.S., M.S.,
Ann Arbor, Mich.

DURING the past few years, manufacturers have been directing their efforts toward the development of new materials for use in dental practice, with the hope of finding some that are superior to the ones now in use. The materials now being used by the general practitioner and the specialist are more numerous than one would expect Many of them are employed in close proximity to the vital tissues—the pulp, the cervical margin and the root sockets—and in the course of partial pulpectomy, root surgery, etc. Because of this close proximity, the question arises as to how these materials are tolerated by the vital tissues. This leads us into the field of vital tissue tolerance.

Because of the large number of materials now in use, experience dictated that, in the course of this study, we should at first confine our investigations to a limited number. Those substances tested in 1930-1931 for the part porosity played in tissue tolerance were hard and soft wood, steel tubes and bone. Materials used in restorations and in root-canal surgery, such as amalgam, gold, copper, guttapercha and lead, and a root sealer, were also tested.[1]

In 1931-1932, tests were made on the following filling materials: glazed and unglazed porcelain, synthetic porcelain (silicate) and copper amalgam. Silver wire was also tested.

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*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Fourth Annual Session of the American Dental Association, Buffalo, N. Y., Sept. 14, 1932.

1. Rickert, U. G., and Dixon, C. M.: Tissue Tolerance to Foreign Materials, Tr. Internat. D. Cong., Paris, 1931.

The ingredients of certain root-canal filling materials were tested, since some of them form a part of the root sealer tested: Canada balsam, rosin, zinc oxide and pure silver.

We are much interested in all materials now extensively used in dentistry, but special emphasis is placed here on those materials used in root surgery since the increasing interest in this subject during the past two or three years makes a further study of it of practical value to every one engaged in the practice of dentistry, whether or not he is a specialist in this field.

From clinical observation, we are of the opinion that the apical third of the root should be absolutely sealed since we have found it to be more porous than the remainder of the root. This eliminates the slow diffusion of the circulatory elements in this portion of the root. It is not always possible to control the limit of our fillings, and since it is better to slightly overfill than to underfill, provided a material can be found which the vital tissues will tolerate, it is important that we study the available materials for vital tissue tolerance.

The second question which came to mind was to what extent the permeability of the substance influenced irritation. This has an important bearing on the properties of root-filling materials in connection with the experimental and clinical evidence outlined above. The results of this phase of the work have been previously reported[1] and time permits only the statement that the more porous the material, the more irritation it produces.

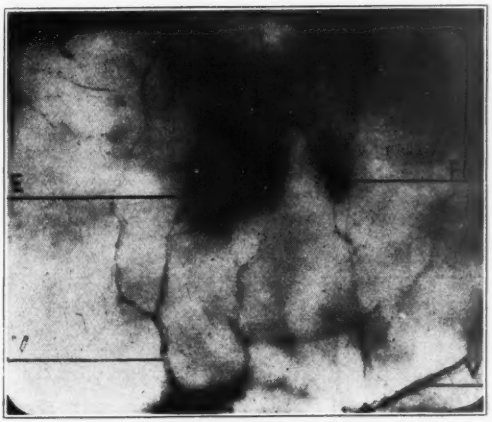

Fig. 1.—Macroscopic appearance of copper amalgam within rabbit skin (actual size). *FB*, foreign body which was removed from area *E* at necropsy and placed within skin for comparison. *E*, extensive reaction. *V*, veins of rabbit skin.

TISSUE TOLERANCE.

Following is the method which we used in studying tissue tolerance to foreign bodies:

1. *Preparation of Foreign Body.*—All the implants were made as nearly the same size as possible, about 0.5 to 0.75 cm. long and 0.1 to 0.2 cm. wide. They were smoothed and polished throughout

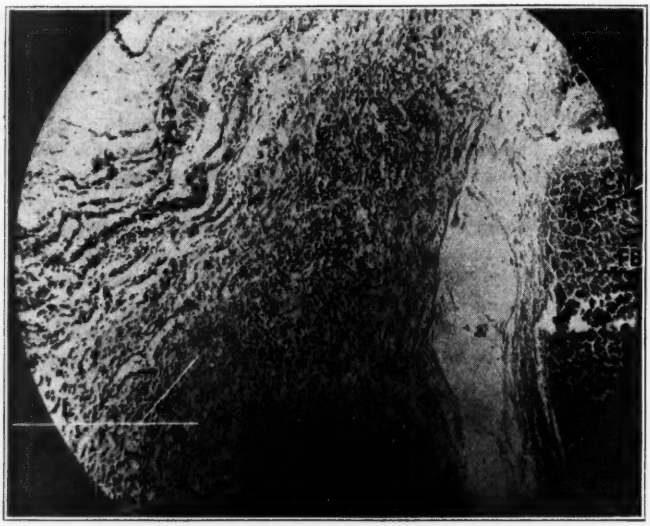

Fig. 2.—Implant, copper amalgam; diagnosis: severe and active chronic inflammation with extensive necrosis; microscopic findings: *FB*, area occupied by foreign body; *CN*, caseation necrosis; *L*, lymphocytes. (×85.)

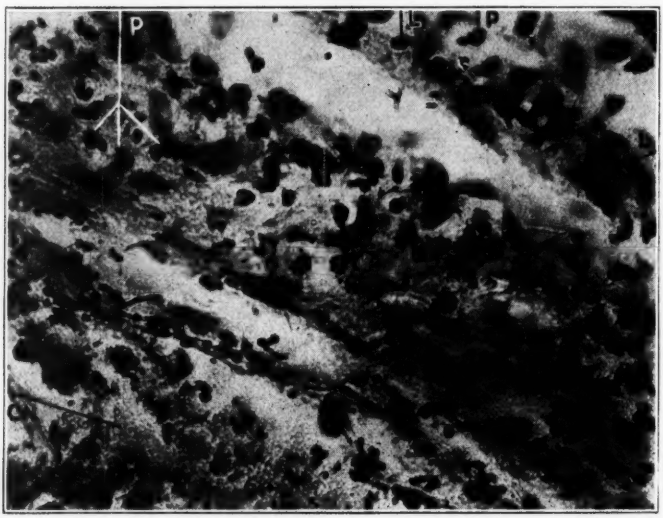

Fig. 3.—High magnification of Figure 2; showing caseation necrosis (*CN*); lymphocytes (*L*) and polymorphonuclear leukocytes (*P*). (×500.)

to avoid mechanical irritation, especially on the ends.

2. *Sterilization.*—The implants were thoroughly sterilized as follows: dry heat (160-170 C.), one hour, or alcohol (70 per cent), twenty minutes.

3. *Technic for Implantation Beneath Skin.*—We have been using rabbits as experimental animals for three years. The backs of the animals were shaved and prepared for the operation in the following manner: An area about 18 cm. long and 10 cm. wide was shaved on the rabbit's back. This area was scrubbed thoroughly with green soap and then washed with alcohol, finally sterilized with tincture of iodine and removed after three or four minutes with alcohol. A 2 per cent solution of procaine was used as a local anesthetic for inserting the foreign materials. From four to six foreign bodies were placed about 1½ inches apart on either side of the spine. A small incision was made with a No. 11 Bard-Parker scalpel directly over the anesthetized area. A pointed instrument was then inserted in the incision, being followed by a small hemostat. The beaks of the hemostat were then opened to form a pocket in the fascia. The foreign body was inserted in this pocket and pushed well beyond the edge of the incision. Many of the incisions were closed with silk sutures, but some were sufficiently small not to need suturing. The latter healed by first intention. Sterile bandages were placed over the incisions. The animals were observed frequently for the first two weeks and at short intervals every month thereafter. The incision healed cleanly in every instance.

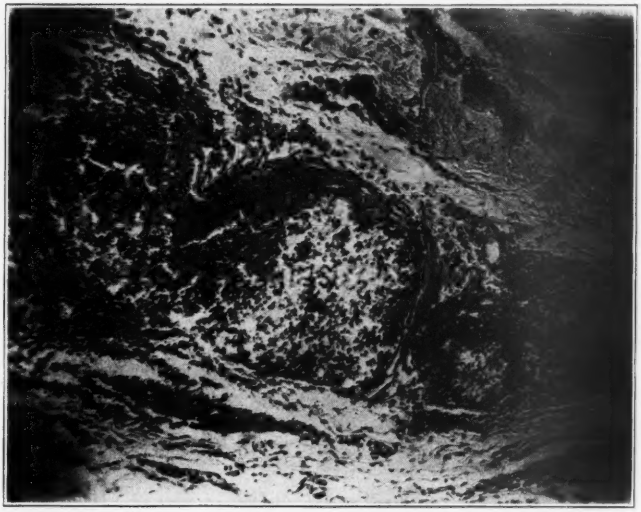

Fig. 4.—Implant, silver amalgam; marked eosinophilic and lymphocytic reaction. (×85.)

4. *Technic for Implantation in Muscle.*—The longissimus dorsi muscles were chosen for the implantation of the foreign bodies. Sodium amytal was used as the general anesthetic. An incision about 7 cm. long was made in the midline over the spine. This was carried through

the skin and both layers of the fascia and by means of hemostats the opening could be retracted to expose either the right or left muscle. An incision about 6 cm. long was made through the ligamentum fascia over the right longissimus dorsi muscle. This, likewise, was retracted sufficiently to insert the foreign bodies in the muscle with enough tissue intervening to allow identification of the particular reaction provoked by each foreign body. The foreign bodies were inserted in the same manner and with the same aseptic technic as those placed in the skin. The ligamentum fascia was then sutured with No. 000 catgut. The opening through the skin and fasciae was then similarly retracted on the left side and the foreign bodies were inserted in the muscle on the left in the same manner. The deep and superficial fasciae and the skin were then sutured. A dressing of 50 per cent metaphen was placed over the incision and covered with sterile gauze and adhesive.

Thirty-five rabbits were used for the experiments conducted during 1930 and 1931,[1] in which 175 foreign bodies were implanted. In 1931 and 1932, twenty rabbits were used, in which 201 foreign bodies were inserted. Of the latter series, 154 were tested beneath the skin, and forty-seven were implanted in the muscles as described above. The average time the implants remained in place before necropsy was five and three-fourths months. After depilation, the skin in its entirety was removed from the area under experimentation and submitted to careful gross examination under strong, direct illumination. In many instances, there was gross evidence of congestion with shadows similar to those around an infected root when transilluminated, only more pronounced,

Final judgment was not passed on the results of this form of diagnosis. It was interesting to compare the gross appearances with the microscopic findings. The various sections of tissue containing the foreign bodies were fixed in formol, sectioned in paraffin at 5 microns and stained with hemotoxylin and eosin. The criteria for the various degrees of inflammatory reaction used in classifying the foreign bodies are given in Table 1.

RESULTS

Only the materials commonly concerned in root canal surgery are reported on here. Other substances related more nearly to filling materials will be reported on in a separate communication.[2]

TABLE 1.—REACTION CRITERIA

Reaction	Interpretation of Reaction
No microscopic evidence of tissue reaction	0
Chronic productive inflammation	1
Chronic productive inflammation with foreign body giant-cell reaction	2
Chronic productive inflammation with foreign body giant-cell reaction and phagocytosis	3
Active chronic inflammation	4
Chronic purulent inflammation	5

1. Copper amalgam, which has been advocated for root surgery because of its antiseptic properties, caused the most marked irritation microscopically as well as macroscopically. This reaction was characterized by extensive caseation necrosis about the foreign body, and lymphocytic and fibroblastic exudate at the periphery. The reaction provoked by this foreign body borders on the purulent type. The diagnosis was: severe and active chronic inflammation with extensive caseation necrosis; degree, 4++. (Figs. 1-3.)

2. Dixon, C. M., and Rickert, U. G.: Tissue Tolerance to Filling Materials, to be published.

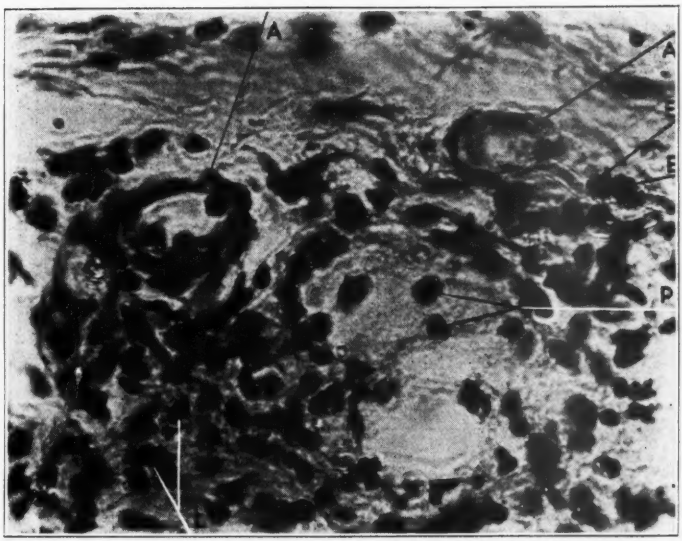

Fig. 5.—High magnification of Figure 4 (silver amalgam), characterized by small granulomatous areas (*A*), eosinophils (*E*), lymphocytes (*L*) and plasma cells (*P*). (×800.)

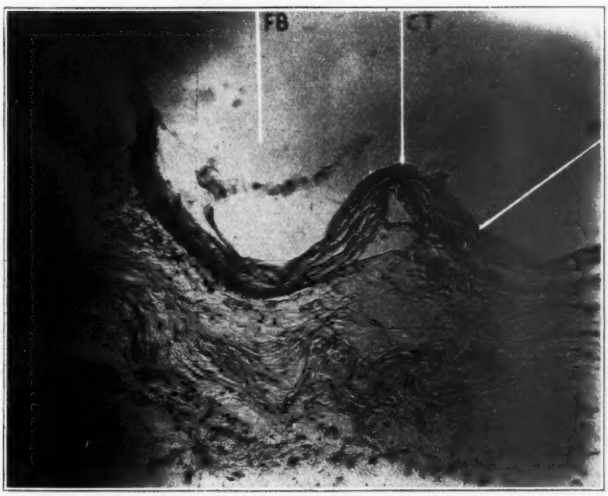

Fig. 6.—Implant, pure silver; diagnosis: active chronic inflammation showing marked cellular exudate; microscopic findings; *FB*, space left by foreign body surrounded by connective tissue (*CT*); *P*, yellowish brown granular pigment, in part crystalline, some threadlike and in part amorphous. The granular pigment is intracellular; the other forms are extracellular. (×85.)

TABLE 2. — SYNOPSIS OF INVESTIGATION

Experiment and Location of Implant	Animals Operated On	Total No. Implants	Average No. Implants Per Animal	Implant Lost		Average Duration of Implants	No. Implants examined		Sterilization	Implant	Gross Irritation	Number Foreign Bodies Diagnosed	Average Degree (Used for Simplicity)	Summary of Results	
				Animal	Technic		Gross	Microscopic						Microscopic	Diagnosis
Tissue tolerance to foreign bodies under skin	15	154	10.2	32	35	5¾ mo.	122	87	Dry heat 160-170 C. one hour or alcohol 70% for 20 minutes	Copper amalgam	Extensive	5	4++	Severe and active chronic inflammation with extensive caseation necrosis	
										Balsam	Extensive	11	4++	Active chronic inflammation with central liquefaction necrosis and marked cellular reaction	
										Rosin	Extensive	4	4+	Active chronic inflammation showing extensive cellular exudate with cystlike formation	
										Silver amalgam	Extensive	9	4−	Active chronic inflammation showing marked cellular exudate.	
										Synthetic porcelain	Slight	6	1++	Chronic productive inflammation	
										Gold	None	8	1+	Chronic productive inflammation with marked cellular exudate	

									Dry heat 160-170 C. one hour or alcohol 70% for 20 minutes	Zinc oxide	Extensive	7	1+	Chronic productive inflammation showing fibroblastic proliferation, moderate cellular exudate
										Pure silver	Moderate	3	1+	Chronic productive inflammation showing connective tissue proliferation
										Unglazed porcelain	Moderate	4	1	Chronic productive inflammation with fibroblastic proliferation
										Silver wire	None	5	1	Slight chronic productive inflammation
										Glazed porcelain	Questionable	7	1−	Chronic productive inflammation
										Root sealer	Slight halo	8	1−	Chronic productive inflammation
Tissue tolerance to foreign bodies in muscle	5	47	9.4	2	20	5¾ mo.		25		Copper	Not observable in muscle tissue	4	4++	Active chronic inflammation, marked cellular reaction, extensive liquefaction necrosis, chromatolysis
										Lead		1	1	Chronic productive inflammation showing fibroblastic proliferation (single observation)
										Unglazed porcelain		1	1	Chronic productive inflammation (single observation)
										Pure silver		1	1−	Chronic productive inflammation
										Root sealer		5	1−	Chronic productive inflammation

2. Balsam, used in several root filling materials, caused a reaction similar to that of copper amalgam. Microscopically, there was a cystlike space divided into many smaller spaces, all surrounded by a cellular reaction of eosinophils, plasma cells and lymphocytes, mononuclear giant cells, numerous epithelioid cells and fibroblasts. The reaction was characterized by well marked response on the part of the reticulo-endothelial system. The diagnosis was active chronic inflammation with central liquefaction necrosis and marked cellular reaction; degree, 4++.

3. Rosin, also used in various materials for filling canals, gave a rather marked irritative reaction. A number of cystlike spaces of varying sizes were left by the foreign body. These cystlike spaces were lined by greatly compressed connective tissue, bordered by a well marked epithelioid cell, mononuclear giant cell and fibroblasts. The diagnosis was: active chronic inflammation showing extensive cellular exudate with cystlike formation; degree, 4+.

4. The use of silver amalgam caused a lesion characterized by small granulomatous areas showing a marked eosinophilic and lymphocytic reaction with some plasma cells and fibroblastic and angioblastic proliferation. The response here was predominantly a cellular one. The diagnosis was: active chronic inflammation showing marked cellular exudate; degree, 4—. (Figs. 4-5.)

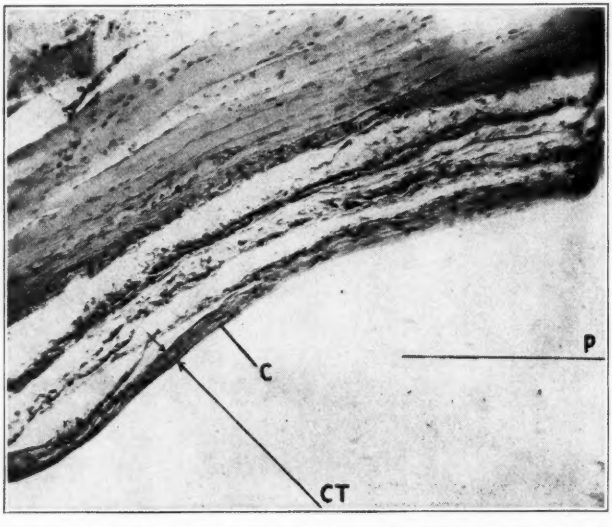

Fig. 7.—Implant, glazed (baked) porcelain; diagnosis: chronic productive inflammation. *P,* location of foreign body before removal. *C,* maturing connective tissue forming a wall about foreign body. (×85.)

5. In the tests with zinc oxide, there was a large irregular cystlike wall, the microscopic section showing from fifteen to twenty rows of fibroblasts and an exudate composed chiefly of lymphocytes with a few plasma cells. Extensive hemorrhage (operative trauma?) was pres-

TABLE 3. — REACTIONS OF FOREIGN BODIES

Classification		Skin													Muscle				
		Degree (Used for Simplicity)	Copper Amalgam	Balsam	Rosin	Silver Amalgam	Synthetic Porcelain	Gold	Zinc Oxide	Pure Silver	Unglazed Porcelain	Silver Wire	Glazed Porcelain	Root Sealer	Copper	Lead	Unglazed Porcelain	Pure Silver	Root Sealer
No microscopic evidence of reaction		0																	
Chronic productive inflammation	Mainly protective	1		+		+	+++	++	+	++	+	+++	+—	+—		+	+	+—	+—
Foreign body giant-cell reaction	Protective and defensive	2		+	+—		+—												
Phagocytosis and foreign body giant-cell reaction		3					+—			+—		+—							
Active chronic inflammation	Mainly defensive	4	+++	++	+	+—		+—							+++				
Chronic purulent inflammation		5	+—												+—				

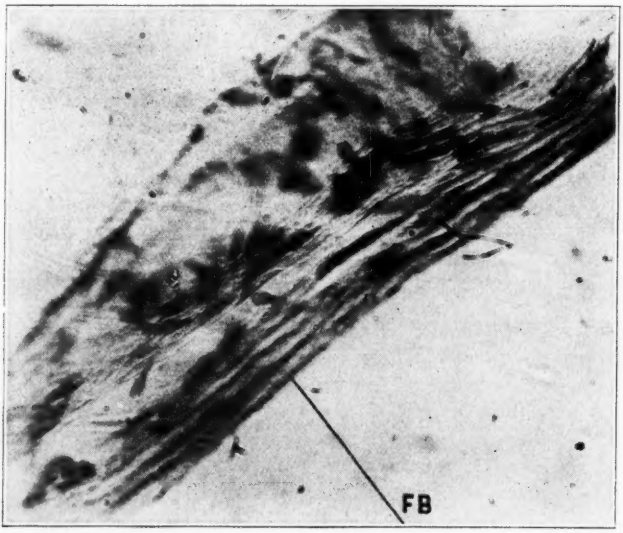

Fig. 8.—Higher magnification of area *C*, Figure 7; showing that glazed porcelain produced only a protective reaction (fibroplastic proliferation, *FB*) with no cellular exudate. (×500.)

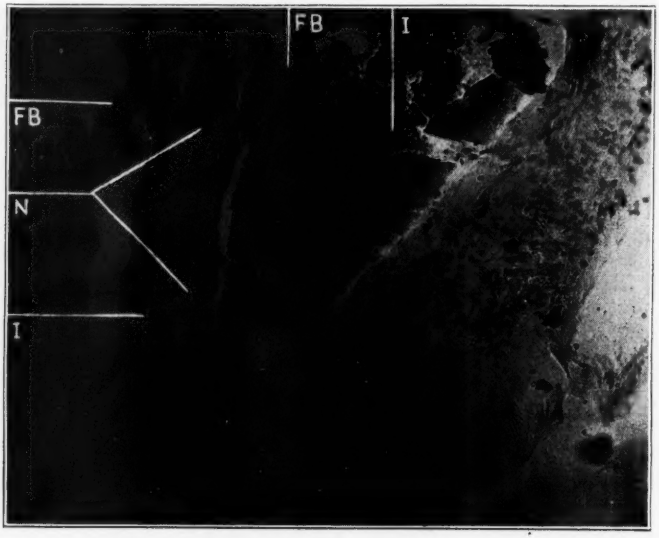

Fig. 9.—Implant, root sealer; diagnosis: no reaction. *FB*, foreign body; *I*, ingrowth of connective tissue surrounding foreign body. *N*, newly formed capillaries. (×85.)

ent in the reactive area. The diagnosis was: chronic productive inflammation showing fibroblastic proliferation; moderate cellular exudate; degree, 1+.

6. With pure silver, the area affected showed a band of connective tissue surrounding the cystlike cavity. Within many of the cells, there was a diffuse yellowish brown granular pigment. This pigment varied in its physical characteristics, showing at times a crystalline, at times a threadlike and at other times an amorphous form. The granular pigment was in part intracellular, the crystalline in part extracellular. The diagnosis was: chronic productive inflammation with connective tissue proliferation; degree 1+. (Fig. 6.)

7. With silver wire, at the site of the foreign body implantation there was a space lined by much compressed connective tissue fibers. Present within the connective tissue could be seen a brownish black granular pigment. The diagnosis was: slight productive inflammation; degree 1.

8. The use of glazed (baked) porcelain (reported here for comparison), on microscopic examination, caused a large open cystlike space surrounded by a wall of several rows of fibroblasts. No cellular exudate was present. The diagnosis was: chronic productive inflammation; degree 1—. (Figs. 7-8.)

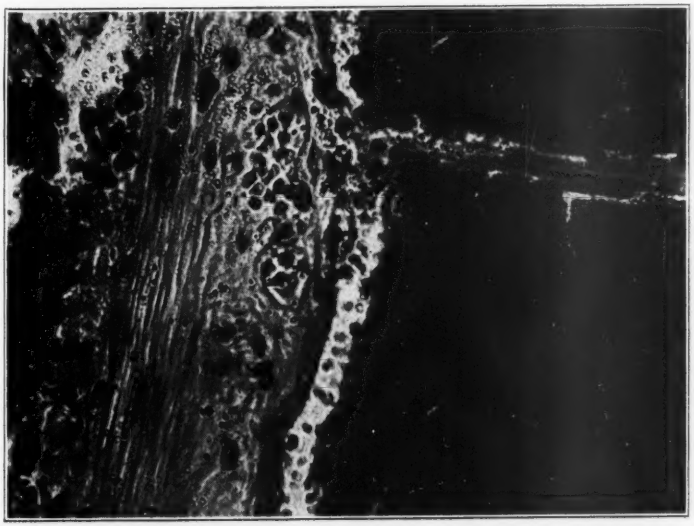

Fig. 10.—Higher magnifiation of area *N*, Figure 9; showing presence of thin walled capillaries within connective tissue, indicating beginning organization. (×500.)

9. With the root sealer employed, there was microscopically a large open space with the foreign body *in situ*. Surrounding the foreign body was a fibroblastic wall without significant cellular reaction. Attempted organization of the foreign body was evidenced by the presence within an accidental fracture of its substance of fibroblasts and occasional small vessels The diagnosis was: chronic productive inflammation; degree 1—. (Figs. 9-10.)

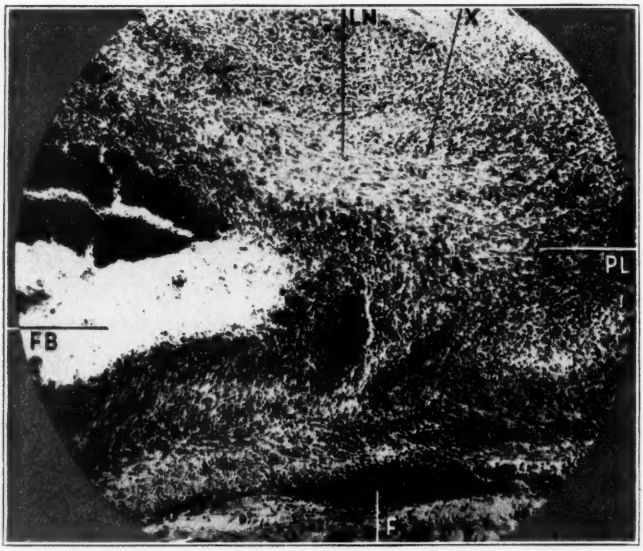

Fig. 11.—Implant, copper, in muscle; diagnosis: active chronic inflammation, marked cellular exudate, extensive liquefaction necrosis, chromatolysis. *FB,* location of foreign body before removal; *L,* lymphocytes; *P,* plasma cells; *LN,* liquefaction necrosis. (×85.)

Fig. 12.—Higher magnification of area *X,* Figure 11; showing cell types as described; *L,* liquefaction necrosis; *C,* chromatin dust. (×500.)

Following are the microscopic reactions to some of the foreign materials implanted in muscle (the remainder forming subject matter for further study and report).[2]

1. Copper, longitudinal section: Marked cellular exudate, chiefly lymphocytes and plasma cells; also eosinophils. The exudate largely obscured the area of fibroblastic proliferation. Liquefaction necrosis was present to a marked degree. Chromatolysis was also present. The exudate was greatly in excess of the fibroblastic reaction and extended for some distance beyond the site of implantation. At the area of implantation, and surrounded by a fibroblastic wall, there was much diffuse chromatin dust. The diagnosis was: active chronic inflammation, marked cellular exudate, extensive liquefaction necrosis with chromatolysis; degree, ++. (Figs. 11-13.)

2. Root sealer: Examination revealed a cystlike space lined by mature connective tissue, irregular in outline and varying in the number of cells present. There was relatively little cellular response. The reaction was a mildly protective rather than a defensive one. The diagnosis was: chronic productive inflammation; degree 1—.

A complete synopsis of the investigation and above-mentioned reactions of foreign bodies are given in Table 2 and Table 3, respectively.

Fig. 13.—Implant, copper; cross-section of area shown in Figures 11-12; demonstrating extent of reaction along sides of foreign body. (×50.)

COMMENT

Our investigation shows that copper, copper amalgam and balsam cause the most marked reaction, and we can, therefore, assume that these substances are the most irritating of the foreign bodies tested this year. Copper amalgam was apparently so irritating that many im-

plants sloughed out after superficial closure. Since copper amalgam is used so extensively in dentistry, we plan to reinvestigate its effect on the tissues and to conduct other tests in an endeavor to elucidate the cause of its irritating properties. Copper causes the same reaction whether implanted in skin or in muscle. Therefore, we believe the reaction of copper amalgam is due to slight solution of the copper rather than to the presence of the amalgam itself, since silver amalgam causes less tissue alteration than either copper or copper amalgam.

Zinc oxide, when inserted alone, produced a rather marked productive reaction and therefore should be incorporated with a substance of such a nature that is not only well tolerated but will, at the same time, so incorporate the zinc oxide as to make it innoxious. This would render it more suitable for cavity lining, the protection of hypersensitive dentin or the filling of root canals.

Pure silver gave a mild reaction as compared to silver amalgam, thus differing from both copper and copper amalgam. We are as yet unable to account for the irritating properties of silver amalgam since the pure silver is quite well tolerated. This tolerance to pure silver may neutralize the known intolerance to zinc oxide, as seen in the root sealer tested and reported above.

Glazed porcelain gave a milder fibroblastic reaction than unglazed porcelain. Although the difference was not very marked, it was sufficient to make advisable the reglazing of porcelain pontics.

The root sealer gave a very mild fibroblastic reaction, similar to the reaction observed last year, some of which may have been incident to the trauma produced by the insertion of the foreign body. This will be made the subject of future experimentation. There was seen in one microscopic field connective tissue growing through a fissure in the foreign body. Apparently, this was an attempt to organize and incorporate the foreign body since the ingrowth was vascularized by newly formed capillaries. Glazed porcelain produced practically the same reaction as the root sealer, and the nature of glazed porcelain is such as to suggest that the tissue reaction is merely one of simple encapsulation (purely protective?) rather than irritative, which also may have been produced by trauma. Thus, the reaction of either root sealer or glazed porcelain is no more than that likely to be produced by any entirely bland substance. Fifteen years of clinical experience with this root sealer, backed by roentgenogram examinations and cultures, points very strongly to the accuracy of this interpretation.

SUMMARY

1. A variety of substances have been tested for vital tissue tolerance in rabbits.
2. Such vital tissue tolerance can be objectively evaluated under conditions of experimentation.
3. Each substance gave a varying degree of tissue response, thus permitting of their enumeration according to the degree of reaction evoked.

The following materials provoke a tissue response of decreasing severity in the order named:

1. Copper amalgam.
2. Copper.
3. Balsam.
4. Rosin.
5. Silver amalgam.
6. Zinc oxide.
7. Pure silver.
8. Silver wire.
9. Root sealer.
10. Baked porcelain.

THE FOREIGN BODY REACTION OF RAT TISSUE AND HUMAN TISSUE TO GUTTAPERCHA*

By EARL P. BOULGER, L.D.S., D.D.S., Chicago, Ill.

THE procedure of filling root canals consists essentially of the introduction of a foreign body into the mesenchyme of the jaw. The outcome of any such operation will of course depend largely on the reaction of the connective tissue to such implanted material.

Two conditions are thereby equally important: infection and tissue reaction proper. The first of these has been thoroughly studied by bacteriologists and dental scientists; whereas, the second has been comparatively neglected at the expense of the bacteriologic aspect of the problem.

This paper deals with a definite problem: How do animal tissue and human tissue react in the absence of infection to the implantation of a foreign material which is at the present time largely used in dental practice, i. e., guttapercha?

Blayney,[1] Coolidge,[2] Davis,[3] Grove,[4] Hatton,[5] Kronfeld[6] and Moen[7] have shown the healing-in of guttapercha in pulp canal fillings. An experimental way of testing tissue reaction to foreign bodies contained in root apices has been devised by Gottlieb, Schwarz and Stein,[8] and I have carried on a similar study.[9] All these investigations and findings led to the belief that, in the absence of infection, guttapercha is well tolerated by the connective tissues of both man and rat.

Rickert and Dixon[10] have used a different method in their study of this problem, implanting various foreign substances without any accompanying dental tissues under the skin and muscle tissue of rabbits. They report inflammatory reactions of varying degrees around almost

*From the Research Department (director, Rudolf Kronfeld) of Chicago College of Dental Surgery, Dental Department of Loyola University.

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9. Boulger, E. P.: Reaction of Rat Tissue to Implanted Root Ends, J.A.D.A., 18:988 (June) 1931.

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all implanted substances. For our own work, it is of particular interest that these authors[10] found active inflammation bordering on the purulent stage around a brand of guttapercha extensively used in root operations.

The latter observation of Rickert and Dixon is, as will be shown, in marked contrast with my own findings. For this reason, I have considered it advisable to study in particular the changes that take place whenever connective tissue of man or rat comes in contact with guttapercha. Thus, my report can be divided into findings on rat tissue and on human tissue.

The first part of the study consisted of the following experiments: Young healthy rats were selected and kept under hygienic conditions on an accepted standard diet. The usual procedure of narcosis, shaving and asepsis was pursued. An incision was made on the inner surface of

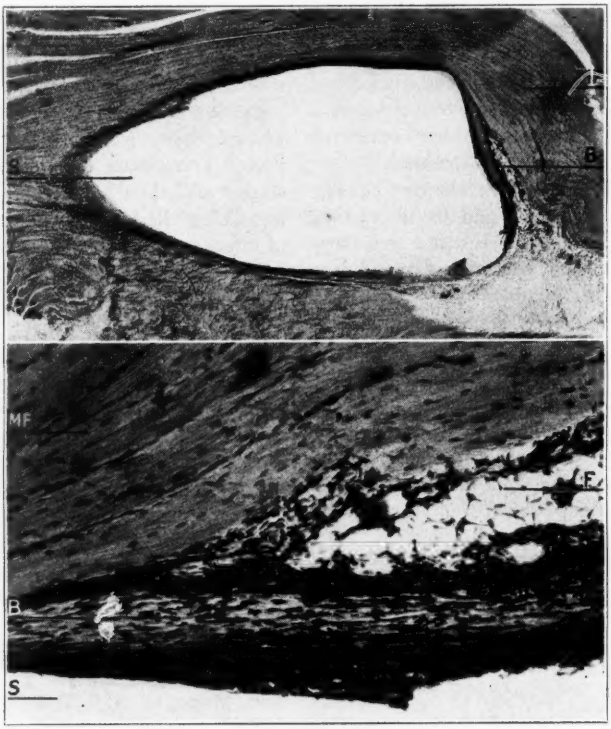

Fig. 1.—Above: Rat tissue surrounding implanted guttapercha cone. The guttapercha had been immersed in 70 per cent alcohol for twenty-four hours prior to implantation (duration of implantation, two months). *S*, space formerly occupied by guttapercha. *MF*, normal muscle fibers surrounding guttapercha. *B*, capsule of connective tissue surrounding guttapercha. Below: Higher magnification of section above. *S*, space formerly occupied by guttapercha. *B*, connective tissue capsule. *F*, fat tissue cells lying between muscle fibers and capsule. *MF*, normal muscle fibers.

the thigh and pieces of guttapercha 1-1.5 mm. thick and 3-5 mm. long were implanted in the muscle tissue. The guttapercha was treated in different ways before implantation. Some of the pieces were taken from the commercial container in which they were delivered and which had just been opened; some were kept in 70 per cent alcohol for twenty-four hours, some in formocresol for a similar period and some were dipped in eucapercha immediately before implantation. Other pieces of guttapercha were obtained by removing the root canal filling from freshly extracted teeth that had been in the mouth for various periods of time and that had showed roentgenographic and bacteriologic evidence of periapical infection.

The healing was uneventful in all instances and the animals were apparently in good health during the course of the experiment. The implanted objects were kept in the rats for two months The rats were then killed and the implanted foreign bodies with the surrounding tissue were excised and sectioned. It was found advisable to remove the guttapercha from its bed to avoid tearing the surrounding tissue in the process of sectioning.

Examination of the sections (Fig. 1) shows the guttapercha surrounded by a fibrous tissue capsule indicative of a foreign body reaction. The muscle tissue of the rat lies in apposition to the cone.

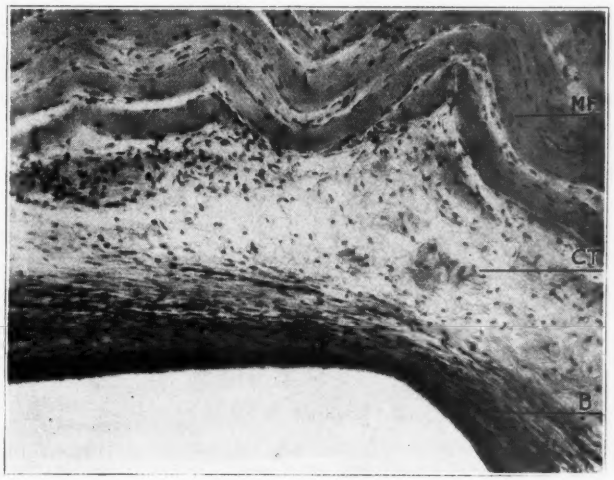

Fig. 2.—Rat tissue surrounding implanted guttapercha cone. The guttapercha had been immersed in formocresol for twenty-four hours prior to implantation (duration of implantation, two months). *B*, connective tissue capsule adjacent to guttapercha. *CT*, loose connective tissue between capsule and muscle fibers. *MF*, normal muscle fibers.

The strands of muscle tissue appear free of any inflammatory reaction. The band of scar tissue is characterized by an increase in the number of cells with less intercellular tissue. There is no evidence of round cell infiltration. In a higher magnification (Fig. 1*B*), the density of the cells in this fibrous band is clearly indicated. A few fat cells may be seen between the fibers of muscle tissue and the capsule. In this particular specimen, the

guttapercha was taken from a bath of 70 per cent alcohol, where it had been immersed for twenty-four hours.

Another specimen (Fig. 2) shows the reaction of rat tissue to a guttapercha cone which had been kept in formocresol for twenty-four hours. The condition of the tissue is the same as in the previous section. A fibrous scar is seen between the muscle tissue and the implanted guttapercha. Bundles of normal muscle fibers were found uniformly in all the specimens in which the guttapercha was free of infection when implanted.

The rats lived from three to nine months before being killed. The rat tissue was sectioned with the root ends in position. Those root ends free of infection became well healed in. A capsule of fibrous tissue surrounds the fragment and extends across the fractured surface and the guttapercha (Fig. 3). The part of the tissue lying in apposition to the guttapercha shows the same structure as that overlying the cementum. In this instance (Fig. 3), the pulp canal had been gangrenous and had been disinfected and filled. Two months later, the root

Fig. 3.—Rat tissue with implanted human root end. The pulp had been removed from this root and the root canal treated and filled with guttapercha two months previous to extraction and implantation. The root end remained in the rat tissue for six months. *D*, dentin of root end. *G*, guttapercha in pulp canal. *B*, connective tissue of rat adjacent to guttapercha and dentin of root. There is no evidence of any inflammatory reaction. *MF*, normal muscle fibers overlying root tip.

Another phase of this study was an examination of root ends having guttapercha fillings which were implanted in rat tissue and reported by me previously. In this experiment, the teeth had been filled and after varying periods, were extracted and implanted in the tissue of the inner side of the thighs of rats. The operation was in all respects similar to the introduction of the guttapercha segments already described.

was extracted and implanted in the leg of a rat. The root end appears well healed in and the guttapercha is well tolerated by the surrounding tissue. Figure 4 shows another specimen in which a vital pulp had been removed and the pulp canal filled. This tooth remained in the mouth for two months; it was then extracted and implanted in the rat. After nine months, the rat was killed and the tissue sectioned. The root end lies in a bed of

muscle tissue. The exposed guttapercha is covered with a layer of connective tissue similar to that covering the root surface. A fragment of the root has been broken off and lies in the rat tissue (Fig. 4*D*). The reaction of rat tissue to this small splinter of dentin is the same as that to the guttapercha: in both instances, we find a fibrous capsule containing young fibroblasts but no exudate cells.

In the absence of infection, the implanted guttapercha becomes well healed in and appears to be as well tolerated by the rat tissues as the root end itself. In Figure 5, the vital pulp had been removed and the pulp canal filled. One year later, evidence of infection was found; the tooth was extracted, and the root end implanted. The rat tissue in this instance shows extensive inflammation due to the infection present when the root was implanted. A small portion of guttapercha in this filling has broken away and lies in a bed of densely infiltrated fibrous tissue.

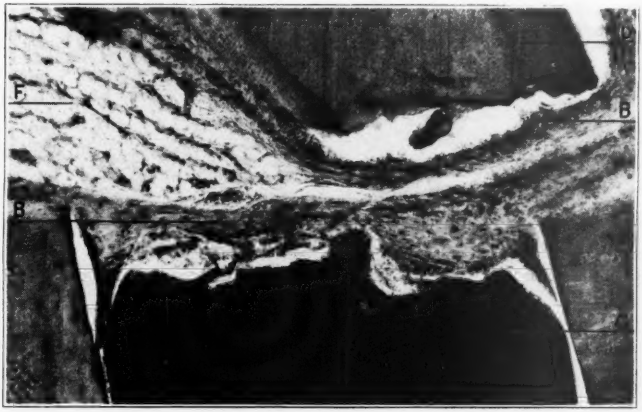

Fig. 4.—Rat tissue with implanted human root end. The pulp of this tooth had been removed and the canal filled with guttapercha two months previous to extraction and implantation. The root end remained in the rat tissue for nine months. *B*, connective tissue surrounding root end and guttapercha. *G*, guttapercha in pulp canal. *D*, splinter of dentin broken off from root end and imbedded in rat tissue. *F*, fat tissue.

Although these reactions of rat tissue to implanted human apices and to implanted guttapercha afford valuable data, we realize that care must be exercised in drawing conclusions from rat tissue alone. Müller[11] has called attention to the fact that the tissues of rabbits and dogs show decidedly different reactions to such implantation. This suggests that the sensitiveness to foreign body implantation varies with different animals, and particularly that it may vary between man and animal. Therefore, it is necessary to compare our findings in rat tissue with corresponding findings in human tissue. The opportunity for such a comparison is given whenever a human tooth with a filled root canal is extracted and the tissues that are in direct contact with the root filling material are examined.

11. Müller, O.: Ueber die Implantation zur Prüfung einer Wurzelfüllmethode, Deutsch Zahnärztle. Wchnschr., 33:406, 1930; Wurzelfüllungsmethoden, Frtschr. d. Zahuheilk, 6:391, 1930.

For this purpose, the apices of three human teeth will be illustrated. In every instance, the root end was slightly underfilled so that the portion of the canal next to the apical foramen contained vital tissue. The first case (Fig. 6*A*) shows the pulp stump of an upper lateral incisor. This tooth had been treated and the canal filled five years previous to extraction. At the time of extraction, the patient complained of slight discomfort, apparently a mild chronic pericementitis. The microscopic examination of the root end showed that the pulp tissue had lost its histologic

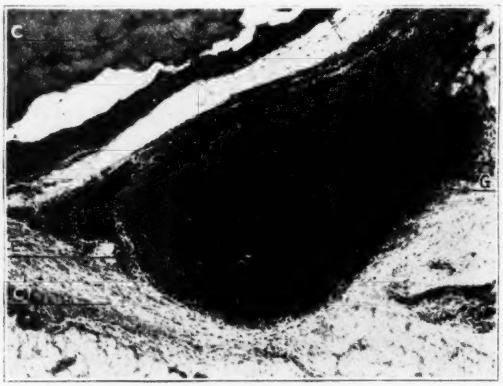

Fig. 5.—Rat tissue with implanted human root end. The pulp of this tooth had been removed and the canal filled one year previous to extraction and implantation. At the time of extraction, the tooth showed clinical evidence of periapical infection. A small piece of embedded guttapercha is surrounded by an area of intense inflammatory reaction. *G*, fragment of guttapercha broken away from pulp canal. *E*, inflammatory exudate cells. *C*, cementum of root end. *CT*, connective tissue of rat. From a comparison of Figure 5 with Figures 3 and 4, it is evident that the inflammatory reaction around the guttapercha in Figure 5 is due to the infection of the root end and not merely to the presence of the guttapercha.

characteristics and had been transformed into fibrous connective tissue. This tissue shows evidence of a low grade inflammation, namely, hyperemia of the capillaries adjacent to the guttapercha, and a small number of inflammatory round cells (polyblasts). This reaction is comparable to the active chronic inflammation found about pieces of copper amalgam, silver amalgam, rosin and balsam in Rickert and Dixon's study. Nearer the apex, there is a deposition of cementum along the wall of the pulp canal.

The presence of an inflammatory reaction next to the guttapercha might be interpreted as the result of irritation of the tissue by the filling material. But it is our belief that this reaction is due to the infection in the root canal rather than to the presence of guttapercha. This belief is supported by the clinical findings of pericementitis previous to extraction and by the evidence in other cases of close adaptation of connective tissue and the deposition of cementum upon the guttapercha in the absence of infection (Figs. 6*C*, 7 and 8).

Figure 6*B* shows the unfilled apical portion of a root canal in an advanced stage of healing. Fibrous connective

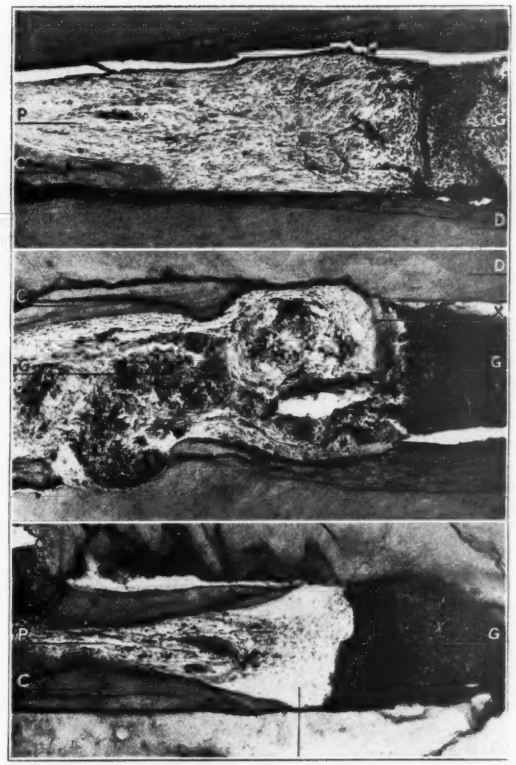

Fig. 6.—Above: Pulp stump and guttapercha in human pulp canal. This tooth had been filled for five years. Clinical evidence disclosed a pericementitis for some days previous to extraction. *G*, guttapercha in pulp canal. *D*, dentinal walls of root canal. *C*, cementum deposited on wall of canal. *P*, pulp stump remaining in canal. This pulp tissue shows a moderate inflammation at the point where it comes in contact with the guttapercha of the root canal filling.

Center: Pulp stump and guttapercha in human pulp canal. *G*, guttapercha in pulp canal and small particles in fibrous tissue of pulp stump. *D*, dentinal wall of root canal. *C*, cementum narrowing lumen of canal. *X*, cementoid deposited directly upon guttapercha. The toleration of the human tissue for guttapercha is emphasized by the deposition of cementoid upon the guttapercha. The fibrous tissue in the unfilled apical portion of the canal is free from inflammation.

Below: Pulp stump and guttapercha in human pulp canal; well healed condition in apical portion of the root. *G*, guttapercha in pulp canal. *C*, deposition of secondary cementum on walls of pulp canal. *P*, strand of fibrous tissue occupying center of unfilled portion of canal. *X*, uncalcified cementum (cementoid) deposited directly upon guttapercha.

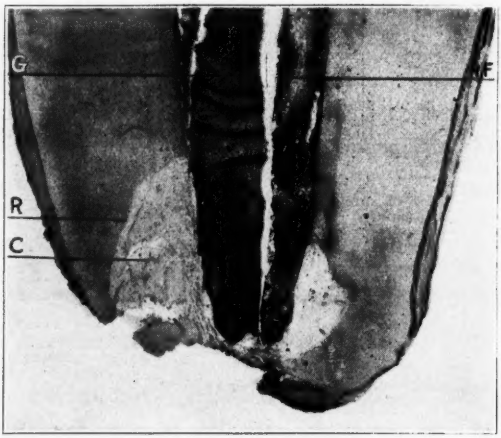

Fig. 7.—Root end of human tooth that contained pulp canal filling for many years. *G*, guttapercha filling. *RF*, plastic root filling material. *R*, area of resorption of dentin. *C*, newly deposited cementum.

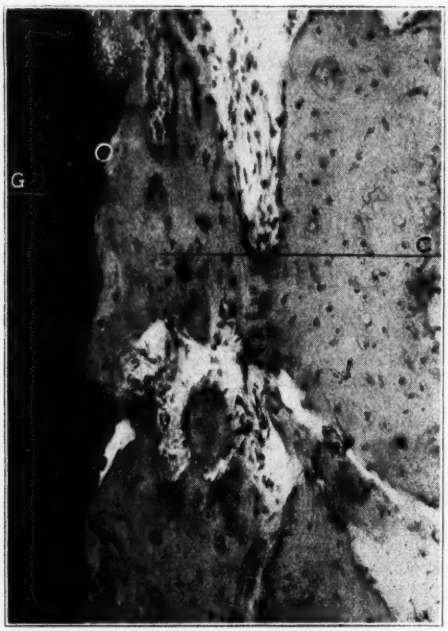

Fig. 8.—Higher magnification of section shown in Figure 7. *G*, guttapercha filling. *C*, newly formed cementum, showing embedded cementoblasts directly upon guttapercha. This close relationship between the root filling material and the living human tissue indicates that this foreign material (guttapercha) is well tolerated.

tissue without any evidence of inflammatory reaction lies in close apposition to small particles of root filling material and to the end of the guttapercha cone. The dentinal walls of the canal had been resorbed as is frequently observed after root canal operations. A thin layer of new cementum has been deposited upon the dentinal walls and upon the surface of the guttapercha.

Figure 6*C* shows a case of advanced formation of cementum in the unfilled portion of the root canal of a lower bicuspid. The width of the remaining portion of the canal has been considerably reduced by the cementum. Special attention should be called to the presence of uncalcified cementum (cementoid) in direct apposition to the guttapercha.

A case of unusually close relationship between a foreign body and human tissues is illustrated in Figures 7 and 8. In this instance, a bonelike substance has been deposited at the apex of a pulpless tooth after extensive resorption of the dentin. The root filling consisting of guttapercha and some plastic filling material appears to extend freely into the newly formed hard tissue. In a higher magnification, it can be seen that the bonelike substance is deposited directly upon the surface of the guttapercha and appears to be actually united with it. Thus the evidence in rat tissue as well as in human tissue is that guttapercha is well tolerated in the absence of infection. Of particular interest is the deposition of cementum directly upon the guttapercha. It has been known that deposition of bone will occur upon implanted bone fragments and ivory in man. Owing to the similarity of such material to the human bone tissue, this may not be considered unusual. But, in our specimens, a similar condition was found about a foreign material, namely, guttapercha, which has no structural or material relation to bone or ivory. This, it is believed, suggests an unusual tolerance of the human tissues to guttapercha.

VALUE TO PATIENT AND PHYSICIAN OF ORAL SURGEON'S DIAGNOSIS*

By STERLING V. MEAD, D.D.S., Washington, D. C.

ORAL diagnosis is the recognition and differentiation of normal and abnormal conditions of the teeth and surrounding structures. Intelligent diagnosis requires correct training in theory and an extensive clinical experience. A thorough understanding of all of the diagnostic methods is essential for the successful treatment of a patient who has come to the physician or to the dentist for the relief of disturbing symptoms.

A study of the diseases of the mouth for the purpose of diagnosis involves the following considerations: definition, etiology, pathology, symptomatology, diagnosis, differential diagnosis, complications, sequelae, clinical varieties or types and treatment, preoperative and postoperative.

*Read before the American Society of Oral Surgeons and Exodontists, Buffalo, N. Y., Sept. 9, 1932.

In many instances, the condition is self-evident and a direct diagnosis may be made. In other cases, the symptoms suggest two or more affections, which must be distinguished by differential diagnosis. Occasionally, diagnosis must be made by exclusion; in which case, all the possible disorders must be ruled out one by one, because of the absence of special symptoms, until finally the real cause is determined. In some cases, especially in some types of tumors, it is necessary to make a presumptive diagnosis, as, at the time of operation or on biopsy, the final diagnosis may differ somewhat.

The chief factors in diagnosis, therefore, are: to obtain correct facts, to interpret them properly, to know what to look for and, above all, to look for it.

One of the greatest services the oral surgeon can render the patient is to endeavor to promote the idea of a complete diagnosis. This is valuable not only in the case of systemic disease, but also in all so-called normal cases, in order to detect abnormalities in their incipiency.

The service rendered in the early detection of caries, erosion, gingival disease, growths, etc., may be of more importance to the patient than the elimination of extensive pathologic areas, but it is not always easy to impress this fact on the patient, because of economic considerations. It is always easier to suggest an operation, but the idea of prevention should also be made acceptable to the patient. The gateway to prevention is through examination and correct diagnosis.

When a patient comes in for the relief of pain or for attention to a particular area, attention should be directed to the great value of a thorough physical check up, both general and oral. This does not mean simply taking a routine set of roentgenograms and making a so-called reading of them.

The examination should be conducted in a routine manner, and the results of the examination recorded on some suitable printed chart, so that an accurate and positive diagnosis may be made, which may be quickly consulted. The following is a satisfactory plan of procedure:

A History
- (*a*) Oral
  1. Chief complaint.
  2. Present disorder.
  3. Past disorders.
- (*b*) General
  1. Chief complaint.
  2. Present illness.
  3. Past illness.
  4. Family history.
  5. Habits
  6. Marital and menstrual history.
  7. Occupational conditions.

B Oral examination
- (*a*) General survey.
- (*b*) Transillumination.
- (*c*) Roentgenograms.
- (*d*) Pulp testing by electric current.
- (*e*) Percussion and palpation.
- (*f*) Exploration.
- (*g*) Color.
- (*h*) Conductivity of temperature.

C Laboratory examination
- (*a*) Blood.
- (*b*) Serologic test.
- (*c*) Blood chemistry.
- (*d*) Bacteriology.
- (*e*) Histopathologic (biopsy).
- (*f*) Urinalysis.

D General physical examination.

E Differential diagnosis.

F Presumptive or working diagnosis.

G Outline of treatment.

H Progress.

I Final diagnosis and summary.

While it is not practical in every case to follow out this complete systematic plan of diagnosis, it is the ideal procedure and so should be followed as nearly as possible.

Intelligent oral operations cannot be

performed without a true diagnosis, and this entails a knowledge of the patient's physical condition. This calls for the cooperation of the oral surgeon and the physician. Cooperation does not just denote working along separate lines by the oral surgeon or the physician, or referring the patient from one to the other, but it should mean working together, combining the knowledge of the two professions, in order to get the best result.

From a practical standpoint, especially when a patient has a lowered resistance, which affects the progress of a case in the hands of the oral surgeon, it is not always sufficient for the oral surgeon to ask that the family physician be called into the case, or to rely on the physician entirely. Physicians differ widely in their views, and it is true that many physicians do not know any more or even as much as the oral surgeon with regard to the proper handling of some of these cases of sepsis. It is quite common to have a physician make a physical examination in these cases covering all points except the blood examination, which, in many instances, is the most important condition to be considered. In order to handle these cases intelligently, the oral surgeon must have a rather comprehensive idea as to just what is required in the way of the physician's examination and know something about the best plan of treatment. It may even be advisable for him to make certain suggestions in some cases, and this can be done in a way that will not offend the physician.

On the other hand, this principle holds true with regard to the physician's relationship with the dentist. All physicians have had experiences wherein the oral surgeon or dentist has given the mouth a clean bill of health and someone else with more experience has discovered a definite oral sepsis. The physician is interested in health problems and he is anxious not to overlook any pathologic condition in the mouth or adjacent parts. He, therefore, often feels it necessary to check the findings of the dentist or to work with someone in whom he has full confidence. Because of his knowledge of the patient's general condition, his suggstions are always helpful to the dentist.

If the dentist is to aid in the study of health conditions at present, it is necessary for him to undertake extensive study and clinical work, so that he will have not only an understanding of the purely local dental conditions, but also an appreciation of the field of the physician as far as it relates to the mouth and adjacent structures.

The dentist must understand the importance of a study of the hemoglobin, red blood count, white cell count, differential count, clotting time, bleeding time and urinalysis, not only for the presence of albumin and sugar, but also for calcium and phosphorus metabolism.

Many physicians do not realize the importance of quickly improving the tissue and blood building mechanism in cases of low resistance, especially in bone disease. There seems to be too much attention paid to the bacteriologic phase without adequate study of the resistance phase of the work.

Most students and most dentists feel that they are competent to make a diagnosis. Most operators have an erroneous impression as to just what constitutes a diagnosis. The experience of most men in a practice devoted to the elimination of mouth factors in systemic disturbance will bear me out, I am sure, in the statement that there are too few men qualified at the present time to aid the physician and the patient in deciding just what mouth conditions are factors in systemic disturbances, and determining the exact

nature of disease reflected in the mouth by general systemic disturbances.

It is not uncommon to find instances wherein young men recently graduated from college decide on a career of the oral surgeon or diagnostician, and embark on this line of work without comprehensive study or preparation. They take a week's course, and all that seems to be necessary is to announce that they are specialists. Clinical experience is one of the necessities for correct diagnosis. The situation as it exists today may finally lead to the formation of a governing board or some other method of determination as to who is competent to do this class of work.

DISCUSSION

A. P. Williams, Louisville, Ky.: To evaluate the service of oral diagnosis, each case must be considered an entity. Each patient presents a separate problem which must be solved according to certain fundamental facts. Dr. Mead outlines an excellent procedure for a complete diagnosis, showing the advantages that accrue to the patient by the combining of the knowledge possessed by the medical and dental professions. It is unquestionably this interdependence of physician and dentist, and the necessity of their cooperation, that becomes more and more apparent as science continues its steady advance in its combat of disease. Dr. Mead mentions the shortcomings of the physician and the dentist in their relationship to each other, and refers to the necessity of diplomatic suggestions. It is true that there may be a divergence of opinion between physicians in their concept of treatment, but, in the majority of instances the physician is, I find, ever ready to act promptly, and usually he will lend his every effort toward any conceivable measure that may prove advantageous to the patient's health. It is at times much more difficult to get cooperation and a ready response from the patient's dentist, particularly when pulpless teeth are in question, for we all know that the pulpless tooth remains in controversial territory in the concept of many dentists. We appreciate that it is often possible to prove experimentally that a disease is definitely due to infected teeth. Yet the fact must not be overlooked that apparently many individuals carry infected teeth through life without showing any manifestation of disease of focal origin. Nevertheless, the continued absorption of bacterial poisons from pulpless teeth may be causing injury to vital organs, as, for example, myocardial disease. While we know that dental infection does cause systemic disease by direct extension into adjacent structures, or by metastasis to distant parts of the body, we also know that the maximum of value to the patient is obtained by the elimination of all dental infection prior to the possible development of systemic disease, rather than an attempt at cure after secondary manifestations of disease have developed. Dr. Mead realizes that when disease is apparent, immediate improvement of the blood stream mechanism is important, particularly in cases of low resistance, instead of paying too much attention to the bacteriologic phase of the case. The resistance is good when enough leukocytes are present, and the blood stream is delivering fresh blood, pasteurized, aerated and at proper temperature, to the body's billions of cells twice each minute. Though we have no accurate way of measuring resistance, we appreciate the fact that to some bacteria we are naturally immune, and to others naturally susceptible, and while the science of bacteriology may be comparatively new, the science of immunology is newer, and our problem is to acquire immunity. Jordan says, "The less completely adapted the bacterium is to the host, the more virulent the disease." Hence, the really dangerous pathogenic bacteria, as a rule, do their damage in a short time. They are not adapted to live in their host—they kill. The fight is between the white corpuscles and the bacteria. If the cells win, we hear no more about it. If the bacteria win, they immediately let us know. Therefore, it behooves us to stress constantly the importance of blood examinations, for there is probably no other condition of equal importance that may be taken as an index of so-called resistance as the blood picture. Dr. Mead, to justify the title of his paper, should have included a paragraph emphasizing the fact that the oral surgeon's diagnosis is valuable because of his special training and clinical experience, in recognizing conditions in the mouth that are definite manifestations of systemic disorders attributable to oral foci.

A. L. Frew, Dallas, Texas: Nearly all the men of this society, specialists in their line, are putting on courses throughout the country at various state meetings, midwinter clinics

and before various groups, and we cannot expect the man who takes these courses not to put our teaching into effect. For that reason, we cannot criticize the general practitioner too much for doing his own extraction work. He is not taking these courses merely for pleasure and observation.

Boyd Gardner, Rochester, Minn.: Every time we think of extracting teeth, we must think of the word "diagnosis." Our specialty, today, is not just the extraction of teeth. It might have been at one time, but we have a responsibility in finding infection and eliminating it. Those of us who are so situated as to have access to the records of the physical findings in all cases in which we are to operate are more fortunate than those who are forced to work more or less without such resources, and it is obvious that this cooperation makes us think more in terms of diagnosis. The physician has been trained, largely by the dentist, to think of teeth only as a foci of infection, but it is high time that we emphasize the fact that dental infection constitutes a load with perhaps no definite symptoms traceable to a focus; that pulpless teeth and pyorrhea can be considered a physical liability when a patient does not have iritis, kidney infection, myositis or any other condition that is considered focal in origin. We should interest physicians in teeth just as they are interested in other parts of the body. Why should a patient travel a long way to seek comfort perhaps in the knee or the head, when he is just as much interested in oral comfort? We should emphasize to our medical associates that decay and pyorrhea are largely systemic manifestations. We must appreciate that the local treatment of pyorrhea, in advanced cases at least, is largely surgical, and are exodontists going to assume responsibility in the management of this disease? We should strive to become better diagnosticians and to be able to associate mouth conditions with conditions elsewhere in the body. We no doubt pay more attention to root end infection and impactions than we do to other conditions of the mouth, and we must assume more responsibility in the management of pyorrhea. More and more, we should see the need of medical cooperation, as it is very easy for us to manage pulpless teeth with definite areas of infection at the root ends, but the so-called roentgen-ray negative teeth are not so easily managed. In such cases, we need medical cooperation. No dentist can cope with the situation single-handed. I quite agree with Dr. Hatton that roentgen-ray evidence does not exaggerate. If the root end of the tooth is in cancellous bone, there may be a large area that cannot be seen with the roentgen rays; whereas, if the root end is in the cortical bone, it is an easy matter to recognize evidence of infection. I recognize that there is more of a difference between the maxilla and mandible from a roentgen-ray standpoint. We must bear in mind that the mandible has a true periosteum and is not even a part of the skull as it can be readily disarticulated. These anatomic variations aid materially in making a diagnosis. MacMillan has pointed out that the maxillary lateral incisor becomes cystic more often than the cuspid or central incisor, merely because of the anatomic position of its apex.

M. Francis Wielage, Miami, Fla.: It is true that exodontia, at one time, probably was mostly the art of removing teeth. To perform an oral surgical operation or make a diagnosis, it is absolutely necessary that we broaden our view on the subject of mouth conditions, even though we may be criticized severely by the medical and dental professions. The practice of oral surgery and exodontia, as a specialty, is in evolution. We cannot stand still. We must grasp the opportunities which are placed before us. The Academy of Periodontology is alert on a certain phase of dentistry which is coming to the front rapidly, dental medicine. There is a huge field between medicine and dentistry, which, at the present time, is more or less a pioneering field. It depends on our standards whether we will enter that field and develop it for our own specialty or leave it open to others who will thus reap the benefits of a science which belongs rightfully to the specialty of oral surgery and exodontia. Our operative porcedures should stand out as something special and apart from the average practice of dentistry. We should be more familiar with the specific condition of the patient which confronts us. It is not a question of making so many dollars. The successful man is not, at the present time, judged by the amount of money he makes. It is the status of his ideas about his profession that will be judged; and, in time, the value of the service rendered. The problem of root canal fillings or devitalized teeth is again coming to the fore. Some of our able men who advocate the filling of root canals tell us that they make a culture by inserting a cotton point to the apex and then placing it in an incubator on a

culture medium, to see whether certain pathogenic bacteria will develop. I mentioned before that it was not the organism which caused the trouble, but the product of the bacteria. If there is some way in which the body is able, through lack of metabolism, etc., to produce a toxin similar in nature to the product of the bacteria, and readily so, as we note in the study of colloidal chemistry, that body being sensitized by the toxin, which is not the product of the bacteria, the culturing alone of the contents at the root apex is not sufficient to allow the filling of the root canal. Consequently, our profession must enter into deeper study of the biochemistry of the body. We cannot any longer depend on the reading of the roentgen-ray film and the extraction of teeth. There is the problem of the surgical treatment of pyorrhea, which in principle we have now accepted as belonging to our specialty. It is not sufficient to perform an operation on the individual and discharge him. We must recognize and treat the underlying systemic condition, and we cannot send that patient back for the physician to eliminate this underlying physical condition and thereby prevent the recurrence of paradentosis. It is the dentist's part to correct the systemic disturbance in cooperation with the physician, if necessary, to prevent the recurrence of this condition. Are we merely going to perform the surgical work and allow other groups to finish the work or allow the patient to drift, with the advice, "If you keep your teeth clean, it will be all right"? The field of diagnosis is so closely allied to that of biochemistry that I should like to see the American Society of Oral Surgeons and Exodontists consider the possibility of accepting the responsibility of practicing dental medicine, that we may give the patient better service.

Dr. Browning: As president, I feel it my duty to correct the statement made that the society has accepted surgical pyorrhea. We have not as a society accepted or rejected it.

Howard C. Miller, Chicago, Ill.: The program committee, realizing that it is difficult to cover all phases of our specialty in the short period alloted for scientific sessions, decided, for this particular year, to present practical subjects rather than ultrascientific. There are many men in this organization who have ideas that would help each of us if they were presented. Your president has followed the plan of restricting the admission to this meeting to members, believing that such restriction would promote freer discussion. We know that diagnosis is the basis of all treatment, the basis of operative procedure. Dr. Winter, in his work on the third molar, did much for us in making us decide what we were to do before beginning operation. In my opinion, diagnosis is the basis for the selection of the anesthetic, the operative procedure and postoperative treatment. It is a most important service in dentistry and one for which dentists are frequently not paid.

PROFESSIONAL SABOTAGE*

By HAROLD S. SMITH,† D.D.S., Chicago, Ill.

DR. JOHN OPPIE McCALL does not like the Council on Dental Therapeutics in general, and its secretary in particular. As a "thoughtful" member of the dental profession, he uses three pages of the *New York Journal of Dentistry*[1] to berate the Council and the secretary in an editorial, the intemperance and vituperation of which are equaled only by its factual distortion and obvious personal bitterness. Ordinarily, such unreasoned diatribes should be ignored, but since Dr. McCall speaks apparently as editor of a publication of a component society of the American Dental Association, these comments are made.

The editorial does not readily lend itself to reasoned discussion because it is

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†Chairman of the Council on Dental Therapeutics.

1. Editorial, New York J. Dent., 3:127 (May) 1933.

palpable that its author is laboring under an irritation. In the absence of any other known motive, one wonders if the writer of the editorial was moved by a desire to retaliate for some official action of the Council. A study of the Council's published reports indicates but one that might have aroused an attitude such as is apparent in the editorial. This report was the one in which a product known as Calsodent was declared not acceptable.

The reader's attention is invited to the following excerpt from the Council's report on Calsodent:

> The foregoing formula [referring to the previously expressed formula] is essentially the one for which a patent was granted in 1929 to John Oppie McCall, D.D.S., New York City, as a "means for and method of detecting and correcting mouth acidity," and which was assigned to The Calsodent Company. Except for the indicators, the formula is essentially the same as one accredited to Hermann Prinz, D.D.S., by Fones in 1927 ("Mouth Hygiene," p. 293). From the foregoing it is apparent that Calsodent is essentially salt, which has been slightly modified by the addition of small amounts of lime and other substances.

In passing, it might also be stated that the product Calsodent was seized by the Food and Drug Administration of the United States Department of Agriculture because it was shipped in interstate commerce in violation of the Food and Drugs Act as amended. The following excerpt from the Notice of Judgment should be illuminating:

> It was alleged . . . [by the Government] that the article was misbranded in that the following statements regarding the curative or therapeutic effects of the said article were false and fraudulent, since it contained no ingredient or combination of ingredients capable of producing the effects claimed: . . . no claimant having appeared for the property, judgment of condemnation and forfeiture was entered, and it was ordered by the court that the product be destroyed by the United States marshal. (Notice of Judgment 19386, Food and Drug Administration, United States Department of Agriculture. issued November, 1932).

Dr. McCall, in one paragraph, compliments the qualifications of the Bureau and the Council, stating in part: " . . . the make-up of the two bodies is such as to command confidence and respect." In a succeeding paragraph, he says, in part: "This being so, *The New York Journal of Dentistry* now finds it necessary to withdraw, for a time at least, its previously announced support of the Council on Dental Therapeutics. It also announces a new policy regarding dentifrice advertising. . . . we now announce a restricted acceptance of dentifrice and pharmaceutical advertising, the acceptance being based on the judgment of the Editorial Board of the *Journal.*" Perhaps Dr. McCall can explain the inconsistency reflected in such diametrically opposed statements in the editorial. One wonders whether the judgment of the editorial board in passing on dentifrices for advertising in *The New York Journal of Dentistry* will be based on Dr. McCall's published statements concerning dentifrices in his textbook on clinical periodontia; on the moods and whims of Dr. McCall and his associates at the moment of the decision, or on the exigencies of the situation in relation to the financial requirements of the periodical.

Dr. McCall's lack of sportsmanship in singling out Dr. Gordon, secretary of the Council, for a bitter emotional attack, is equaled only by his pitiful display of ignorance in respect to the subject of his editorial. This is particularly regretable in relation to the fact that among the prime requisites for effective editorial leadership are honest courage and truthfulness.

The gross distortion of some facts, and

the unashamed fabrication of others contained in the editorial, should be obvious to any "thoughtful" member of the dental profession. To my knowledge, Dr. McCall has never put foot in the offices of the Council or the Bureau of Chemistry of the American Dental Association. He is not personally acquainted with the secretary of the Council. Perhaps these two facts might serve as an explanation for his paucity of knowledge of the activities of the Council and the Bureau, of which he speaks with such certainty.

The editorial states: "In the first place, Dr. Gordon's chemical investigations are carried on in the Bureau of Chemistry of the American Medical Association." It has long been common knowledge that since May, 1931, the activities of the Bureau of Chemistry have been housed in the Central Office of the American Dental Association. The offices of the Council, since its inception, have been in the Central Office of the Association. Even if the statement made in the editorial were correct, it may be pointed out that the work of Dr. Gordon, which he carried on single-handedly prior to the creation of the Council on Dental Therapeutics, received the praise of Dr. McCall's own society through a resolution adopted therein and published in the public press. Further, in this connection, it might be stated that Dr. Paul R. Stillman, author with Dr. McCall of a textbook on clinical periodontia, suggested, in 1926, before the Section on Periodontia at the International Dental Congress, that they memorialize the American Medical Association with a request to investigate certain proprietary products sold to dentists.

The editorial states: "Dr. Gordon is a pharmacist and a chemist. . . . " The fact is that Dr. Gordon is not a pharmacist.

The editorial further states: "Dr. Gordon takes an evident pleasure in castigating those products, which he, in all his wisdom, has decided not to approve for the Council." Dr. McCall again demonstrates that he is grossly ignorant as to the modus operandi of the Council. Perhaps he has preferred not to acquaint himself with the following published rules and methods of the Council, which would have quickly disclosed to him the inaccuracy of his editorial statements.

HOW THE COUNCIL WORKS

The procedure of the Council has been published elsewhere. It would not be repetition to put before this body an outline as to how the Council works, for, in the last analysis, the Council is but the servant of the profession in its field of the public health.

The Council is divided into a number of committees, such as the Committee on Rules and Procedure; Committee on Pharmacology and Therapeutics; Committee on Bacteriology, Pharmacy and Chemistry and Committee on Lay Advertising. Of necessity, the work of the Council is carried on entirely by correspondence. Hence, an elaborate indexing and filing system is maintained by the secretary at the headquarters building, communication between the members being through a bulletin prepared by the secretary at regular intervals and sent to each member of the Council. Each bulletin is accompanied by a summary sheet and a vote sheet, by means of which votes and discussions on the material presented in each bulletin are taken. Thus, the expressions of the members will be their own studied opinions and are not influenced by personal considerations such as may arise in meetings.

When a product or an item of business comes to the Council for consideration, it is assigned to an appropriate committee, a member of which is asked to act as referee, and all pertinent data available are sent to him. The referee's name is not disclosed. In due time, the report of the referee appears in the bulletin, following which discussion is asked, and a vote taken after the appearance of the discussion. In general, the material in the bulletin is arranged in orderly fashion, such as recommendations, reports, supplemental reports, discussion, motions, correspondence and votes. By

means of the bulletin, fulfilment of the Council's announced objective — a continuously functioning body—is made possible. (THE JOURNAL, 18:2214 [Nov.] 1931; Tr. A.D.A., 73d Ann. Sess., p. 256, 1931.)

It is clearly apparent that neither the chairman, the secretary nor any other individual member of the council can dominate the Council's decisions.

Dr. McCall charges the Council (through Dr. Gordon) with " . . . evidence of almost total lack of familiarity with the basic principles of the physiochemistry of mouth hygiene, . . . " and says further: "Dr. Gordon exhibits a lack of consistency with regard to dentifrices, for instance, which is most damaging to the prestige of the Council. He sets up a dictum, with whose validity we are not here concerned, that the only office of a dentifrice is to clean teeth, and then proceeds to apply this yard stick, not to the product itself, but to the advertising messages by which it is presented to the public." Does Dr. McCall forget the statements in his textbook on clinical periodontia:

> Contrary to expectations the advocates of this method have found that dentifrices, in the ordinary sense of the word, are less necessary than when other methods of caring for the mouth are employed.
>
> The compounding of drugs in dentifrices originated in the older theories as to etiology of dental and periodontal disease. *So called acid mouth and bacterial activity have furnished the basis for the introduction of most of the drugs now employed in these articles. Later studies have shown them to be without actual value and to be potentially injurious.* [Italics not in the original.]
>
> The dentifrice is considered an agent for the mechanical cleansing of the tooth surface. . . . the virtues which have been attributed to the dentifrice seem in reality to appertain to the tooth brush.

Is this any different from what the Council has said: "The sole function of a dentifrice is to aid in keeping the teeth clean by the removal of loose food débris by the mechanical use of the tooth brush. (THE JOURNAL, 17:1943 (Oct.) 1930.

Again, one wonders if Dr. McCall's present mood on dentifrice advertising is consistent with his avowed position on dentifrices as found in his textbook.

It is appropriate, in concluding these comments, to suggest, constructively, that the "thoughtful" editor contemplates the risks to editorial and journalistic standing involved in the publication of such an intemperate and inaccurate editorial.

The Council at all times welcomes constructive criticisms from the members of the dental profession. It is ready to make available to those interested factual information regarding its activities.

The Council does not consider the problem of dentifrices as one of major importance in dental therapeutics. It regards the sphere of dentistry in a far broader sense.

PRACTICAL DISCUSSION OF NITROUS OXIDE-OXYGEN ANESTHESIA*

By W. J. McLAUGHLIN, D.D.S., Bridgeport, Conn.

IT is not my purpose to describe the technic of nitrous oxide-oxygen administration, or to comment on the various and varying physiologic phenomena associated therewith. These have been presented in detail so often and with such stereotyped exactness as to become trite. We have been thinking entirely too much in terms of ourselves as the actors on the little stage of our endeavor, and not enough of the patient.

I want to stress the importance of the comfort of our clients, regarding as paramount those factors in the administration of nitrous oxide-oxygen that will minimize, if not eliminate entirely, the unpleasantness of their visit to my office and yours. I want to take the unpleasantness out of our work as it pertains to the patient, and, incidentally, to make our own part more agreeable.

By formulating the conditions that have made, from my own experience, for the discomfort of my patients in my practice as an exodontist with a nitrous oxide-oxygen penchant, I will discuss under each heading what I have done and when and where I have been unable to effect any amelioration. I have listed these unfavorable factors in the situation as follows:

1. The bad impression produced by the physical environment on entry to the office of an exodontist and oral surgeon.
2. The innate revulsion to involuntary unconsciousness under a general anesthetic.
3. The sensation of suffocation, or drowning; the head noises; the accelerated and palpable heart beat.
4. Unpleasant dreams.
5. Nausea.
6. Excitability and combativeness.
7. The sensation of lassitude and depression following the use of nitrous oxide-oxygen.

1. While it is impossible to eliminate absolutely the suggestive atmosphere of a dental office, especially one limited to the specialty of exodontia, the most favorable and quieting reactions are invariably effected by developing an environmental calmness even in the physical equipment of a place. Richness without the slightest form of blatancy in the furnishings of the reception room; subdued and neutral wall tones; pictures and literature with a cultured appeal; avoidance of the luxurious; orderliness. It is well, if not imperative, to so locate the reception room as to drown unpleasant sounds from the operating rooms. The prevalence of medicinal odors can be prevented by pleasant neutralizing or antagonizing agents. The approach of the individual members of the personnel, each in his or her particular sphere, to the patient should round out the ensemble of quietness and calm.

All this, of course, seems irrelevant to the subject of our discussion, except as

*Read before the American Society of Oral Surgeons and Exodontists, Buffalo, N. Y., Sept. 9, 1932.

viewed in the light of the psychic relationship of all these matters to the success of our purpose in leading the patient to react with less dread of the anesthetic.

With this idea still in mind, we try to avoid a hospital air in our office. We do not stress the momentousness of the occasion. While we do not minimize the importance of his well-being, we try to maintain an atmosphere of matter-of-course and reassurance without any sacrifice of propriety.

2. Difficulty in overcoming a natural aversion to involuntary unconsciousness is experienced most often with the inexperienced patient and with children. The latter are surprisingly amenable after the first experience, if this has been gone through with little or no physical restraint, and no pain has been felt. With the adult, it is the personal equation. All of us find it necessary to draw on whatever strength of character we possess and to bolster up our courage a little to have a tooth extracted under a general anesthetic. Some of us prefer "to know what's going on" and would elect to have the needle. Our objection to gas is not necessarily based on any previous unpleasant experience or reactions. In the majority of cases, the reassurance of the operator, with an explanation of how the thing is done, how easy it is and how quickly the operation is performed, being just a matter of moments, will effect a conversion, or diversion, perhaps, to the nitrous oxide-oxygen route. Of course, the sympathetic cooperation and persuasion of the trained nurse, prior even to our own approach to the patient, is of inestimable value.

As I have said, this matter of the patient's opposition to a general anesthetic is a personal question. With many, a great many in fact, it is, I believe, merely an affectation calling for a little coddling or sympathy. With others, it is really a complex, demanding the use of all the resources one has by nature or development. From my own experience, I feel that much of this skepticism about nitrous oxide on the part of the patients is born of the old tradition regarding gas administration when it was somewhat of a hit-or-miss proposition. We had not the coordination of a trained personnel. We did the work single-handed. Sometimes, we saturated the patient sufficiently to remove a tooth or teeth before he recovered; oftentimes, he was conscious or semiconscious before the actual completion of the operation. An ineffaceable dread of gas was the result.

I believe that the development of modern thought and education has aided us in the dissipation of prejudice against "going to sleep" to have a tooth out. "Speaking of operations" is nowadays as popular as speaking of the weather for breaking a conversational deadlock. This seems to me to be a manifestation of the present day attitude as compared with the old-time feeling of flirting with tragedy and death when an operation, however slight, was undergone.

3. Apart from a natural antipathy to a general anesthetic, there are the actual subjective symptoms of a not pleasing character produced in the process of inducing anesthesia. I have placed these as the third factor in discomfort as regards the patient's relationship to the procedure. I refer to the sense of suffocation experienced by those "taking gas," to the head noises and to the accelerated and palpable heartbeat. This fact stands in the way of a complete acceptance of nitrous oxide-oxygen as the anesthetic of choice for our work. Believing this, from an experience of many years, I have given much thought to the preven-

tion of these distressing conditions and have compared my analysis with that of others competent to form conclusions.

Of the three distressing symptoms to which I have referred, that is, the sense of suffocation, head noises and accelerated and palpable heartbeat, the sense of suffocation seems to be of mechanical origin possibly referable to an inherent defect in equipment. I believe that when we can maintain automatically the same respiratory equipoise in the mask, whether nasal or oral, or both together, that we are accustomed to while breathing the air normally, at our accustomed sea levels, we shall go far in solving this problem. There must be a perfect balance that will cause no appreciable effort whether we are inhaling or exhaling. Of course, I am speaking now of the patient in the inductive stage of anesthesia, when he is still conscious.

A letter of inquiry addressed to E. I. McKesson and regarding his explanation of the sensation of suffocation brought a reply covering a variety of causes, as follows:

1. Insufficient pressure of gases at the inhaler to assist inspiration through the nose particularly where the air passages are restricted. I induce with 5 mm. pressure to correct this.
2. Gases which have an abnormal odor—perhaps ammonia or nitric oxid.
3. Fear on the part of the patient. Some people imagine they cannot breathe with even a large oxygen tent over their heads.
4. Shortness of breath due to pathological conditions of the lungs, blood or heart. No. 1 above corrects most of such cases.

His first statement of cause, and the one which he seems to stress, is my own theory, in principle at least. Like him, I find that the 5 mm. pressure, on the McKesson machine, approaches the ideal condition. This has to be manipulated according to the immediate requirements, which are constantly varying; and it is not automatic. Most patients are in a hurry, as it were, to breathe when the mask is placed and tend to defeat our purpose to maintain a comfortable balance between intake and escape.

I have found some modicum of success in instructing the patient to be in no hurry. Invariably, he feels that he has to help the machine in putting himself to sleep, and there exists in his mind a peculiar expectancy that unconsciously accelerates and exaggerates his ordinary respiratory rhythm. I think this is purely a psychic reflex and is not of physiologic origin.

I have a feeling that the valve mechanism in different types of machines does not work freely enough, that there is not a perfect synchronism with the patient's breathing, especially as regards exhalation. With this idea in mind, I have experimented and I have reached a conviction that a valve working by gravity alone on a perfectly horizontal level will give the best results.

These, of course, are my own conclusions. They are offered for what they are worth. I have spoken with other operators who maintain that a lack of oxygen in the mixture creates the suffocating effect. Others say that it is a condition peculiar to some people, especially of the full-chested, full-blooded, plethoric types.

I confess that I have not solved this problem, but I have minimized the difficulty to a great degree by starting the induction with a face mask and a valve such as I shall describe. Whatever I have accomplished in this direction has been the result of my patients' experience. I have varied my technic and checked up the different effects with the patients' descriptions, endeavoring on this basis to stabilize my procedure, and with some degree of success.

At this point, it is apropos to stress

the importance of the patient's impressions as a guide toward effecting improvement in our methods. For too long, we have been considering them objectively solely. We should find out what the other fellow feels about it: what are the distasteful elements as far as he is considered and how they can be removed without sacrifice of basic efficiency and good service. The golden rule applies here. Let us consider the patient subjectively.

The head noises and accelerated and palpable heartbeat are disconcerting phenomena to the patient. I think these are partly physiologic and partly psychologic. Undoubtedly, the anesthetic disturbs the normal function of the heart. The vitally sustaining element of oxygen in the blood, what a purely refined gasoline is to the engine of our motor car, is replaced by a foreign element, and we do not get a smoothly running machine. To express it crudely, we have a knock in the engine. There seems to be a field for research along this line, with a view to eliminating this experience. This sphere belongs, of course, to chemistry and physiology.

Independently of the physiologic reactions of which I speak, the head noises and exaggerated heartbeat are augmented by the excitability of the patient; that is, the reactions are reflex in character and depend on the temperamental make-up of the patient. The reactions of this character are subject to material modification by the influence of the patient's surroundings and the sympathetic and reassuring attentions of the dentist and his assistants.

Before I leave the consideration of these subjective disturbances while the patient is in the inductive stage of anesthesia, I would venture to suggest that a too rapid induction may be a contributing factor.

4. The mental reactions of the patient in the unconscious stages of anesthesia, as manifested in dreams, are, I am afraid, beyond our control. I suppose this field belongs to the psychoanalysist. Incidentally, it would seem a good field for his activities. It is remarkable that most patients experience identical dreams on every occasion. While this factor, though sometimes extremely disagreeable, is of minor importance, there are many hypersensitive people with whom the anticipation of these unpleasant fantasies is the sole deciding factor in the choice of an anesthetic.

For the alleviation of this distressing possibility under gas anesthesia, I can do no more than suggest some method of autosuggestion for the patient immediately before the operation, or, if practicable, a preparatory course extending over a longer period of time. It occurs to me at this point that the subconscious stage might be so shortened by quick induction that no mental pictures would have time, as it were, to form. The contraindications for quick induction, under the preceding headings, must receive consideration.

5. Nausea is a most objectionable condition following the administration of nitrous oxide-oxygen. While we do not have to accept it as essential by any means, its incidence is rather high.

I believe that postoperative distress is in direct ratio to the length and depth of anesthesia. This has led me to the conclusion that there is some connection between the incidence of nausea and the combination of oxygen with nitrous oxide. In the days when I gave straight nitrous oxide by quick induction, the prevalence of nausea was negligible. It

was an experience that came with prolonged anesthesia.

Repeated disturbance of the levels of anesthesia during operation is apt to contribute to nausea. The maintenance of an equable flow and mixture produces the happiest results.

It is with no sense of alarm, of course, that I consider nausea, but scarcely any other reaction will create an equal prejudice. It is, perhaps, the one consideration that will lead me to decide in favor of procain, if the patient himself is indifferent to the choice. The type most susceptible is the bilious. They give a history of sea-sickness, car-sickness, etc. If one of these patients is insistent on having nitrous oxide, I use quick induction with the face mask and work against time. I try to avoid saturation.

I have found racial propensities to this distressing state. These, I believe are referable to habits of diet.

Furthermore, I think there is an olfactory contribution to the occurrence of nausea, and that sometimes the initial experience will develop a fixation. The smell of rubber will be enough to cause distressing and suggestive thoughts of nausea. Remove this thought association and we get better results. When I suspect that the patient is of this type, I drown the odor of the rubber mask with a more pleasant smell, such as of essence of orange, or a scented talcum powder. I think that I have effected an improvement.

6. The physical manifestations of excitement and combativeness are more marked in the male sex. If they are exhibited by the female in any commensurate degree, it is by the amazon type. I am speaking of the phenomenon as it occurs in the second and third stages of anesthesia. It occurs also in reverse order when the patient is recovering. Nothing is more distressing to both the operator and the patient.

Excitability and combativeness are, of course, almost characteristic of the heavy smoker and of the alcoholic.

I have noticed a peculiarity about this type of patient: he changes from nasal to mouth breathing at about the second level of anesthesia. I have not been eminently successful in overcoming this tendency. I have acted on the information of different authorities and have experimented along my own course. I do not think that there is an outfit on the market today that will adequately take care of mouth breathing when the patient changes from nasal to oral respiration. The apparatus, as designed, does not deliver volume to the mouth commensurate with the patient's lung capacity. There is a subconscious sense of strangulation, with a physical manifestation of effort to escape the experience and the resultant exhibition of combativeness with the inability of muscular coordination.

For the patient's safety and my own, I use restraining straps. The strap equipment is part of the chair and can be adjusted unobtrusively. I prefer quick induction with a face mask and a small mouth prop. This permits the patient to breathe through either the nose or the mouth. If the operation seems to demand some time, I anesthetize the patient well beyond the point of reflex reaction, or of pugnaciousness, and maintain the desired though rather profound level with the requisite oxygen. If the work can be executed quickly, such as in the extraction of one tooth, or many pyorrheic teeth, I do not produce the same degree of saturation and I take the chance that the straps will be able to restrain the refractory patient while I am operating.

I have been experimenting lately on this type of patient with a premedication

(half-hour) of 3 grains of nembutal, a barbituric product. I can highly recommend this method.

7. The sense of lassitude and depression following the use of nitrous oxide-oxygen anesthesia is in direct relationship to the depth and length of anesthesia. The feeling may be one of relaxation, which is, of course, pleasant to the patient. It may be an expression of the patient's morbidity. Seldom does this sense of depression extend beyond the day of operation. Probably, it is a manifestation of shock. When it has been too pronounced, better judgment would have indicated hospitalization. This is the exceptional case. The character of the exodontist's office has changed essentially from that of the general practitioner. It is something in the nature of an emergency hospital. We can pride ourselves on the development of a new institution in this regard. Our patients' response of appreciation to the little attentions and the solicitude of those attending them is a criterion of the value of the service that we are trying to give. Nothing has gone farther to make the specialist's office what it is and aims to be than the facility of administration and the flexibility of nitrous oxide-oxygen as an anesthetic. Its virtual innocuousness has been accepted by the laity.

In my experience, I have attained the greatest facility in the induction of nitrous oxide-oxygen anesthesia through the use of the face mask. My patients are better pleased with their experience therewith than with the nasal and mouthpiece applied separately. I have made a point of asking those with whom I could take that liberty to compare the one method with the other. The more favorable impression was had from the face mask.

With the cooperation of a friend of mine who is an engineer, I have designed a double yoke to be attached to the gas machine. One arm is for the face mask, the other holds the nasal cap and the small mouth cap. The supply of gas is controlled by a two-way outlet valve. The face mask is of such shape and size as to enclose the extended mouth and the nose in the normal case, and automatically conforms to the facial contour without discomfort through the use of a pneumatic rubber cushion enclosing the edge of the mask. A minimum of pressure is needed to seal it hermetically. The principal feature in the mechanism of this mask is the exhaling valve. It is placed horizontally so that it can function entirely through gravity and is consequently as self-regulating and self-conforming to the patient's breathing habits as the presence of a minimum of friction will permit.

Most of the induction is made through this face mask, and as soon as the desired stage of narcosis is reached, I switch the valve and change to the nose piece, with very little effort. The attachment holding the nose piece has been draped over the patient to facilitate immediate adjustment and application. I have the small mouthpiece at hand to correct any temporary departure toward the conscious level on the part of the patient.

Some of the opposition to general anesthesia comes from the medical profession. This is not necessarily predicated on actual experience: it is a sort of academic prejudice, coming from a too literal interpretation of textbook lore. I am not gainsaying the excellent effect of medical cooperation or the value of the physician's judgment. With the latter's acquiescence, and sometimes under his supervision, which I am always more than willing to invite, I have worked for considerable periods of time on advanced diabetics without any untoward effects. Pregnancy

has never been a contraindication *per se* in my practice.

As regards general anesthesia, we have been burdened too much with a formula. It is all very well to know about the stages of anesthesia; the induction stage, the excitement stage, the surgical stage, and the danger zone, with all their various strata and differentiations. We are ready to adjust this gadget and that one according to the chart we have pictured in our mind's eye. We are eternally looking for these illusive lines of demarcation between the stages about which we have studied so much. We measure the relative lengths of inspiration and expiration, and try to note whether the eye oscillates eccentrically or horizontally. In short, we are too mechanical and precise and we escape the true "anesthetic sense."

I have used the expression advisedly at this juncture. It leads me to the conclusions that I would stress at the close of my discussion in regard to the giving of anesthetics, especially nitrous oxide-oxygen. For the work which we have undertaken, we should develop that acuteness of hearing and vision that will immediately record any departure from the normal while the patient is under the influence of the gas. It is a peculiar perception that comes from experience only and an intelligent interpretation of evidence. This evidence is not arbitrary in its indications. Each patient is a law unto himself. The "anesthetic sense" will allow us a wide latitude within the limits of perfect safety.

The paramount factor in preserving the safety and efficiency of nitrous oxide-oxygen anesthesia is the freedom of the air passages. It almost invariably will be found that any variation in the normal rhythm of things during the various stages of anesthesia is referable to an interference with the required flow of the gas. It behooves the operator to discipline his mind to a consciousness of this. Even the very manipulations necessary in the extraction of the teeth affect the freedom of inspiration and expiration. He should properly punctuate his operating with brief rests of recovery for his patient. This can be done methodically without any great sacrifice of time, and he will find that the end justifies the means.

SUMMARY

Whatever of worth there is in the practice that I have built up is due mainly to my consistent use and advocacy of nitrous oxide-oxygen. I have done so from the honest conviction that it comes nearest to the ideal in the matter of anesthetics and is especially adaptable to the requirements of an exodontist. Experience strengthens my partiality to it. After all is said, for or against, this is the best test.

I have carefully and purposely abstained from any reference to the use of procain in comparison with that of nitrous oxide-oxygen. I hold that there are arguments in favor of both and that the choice is mostly a personal one. The appeal that the general anesthetic made to me was in consideration of the patient. Mainly, I was interested in the absolute elimination of pain: pain not only in the physical sense, but principally in the psychic sense. The preponderance of our operations are of short duration and they are uncomplicated. I find immense satisfaction in having most of my patients capable of leaving my office in a matter of minutes and exhibiting evident satisfaction that the experience has not been at all unpleasant.

DISCUSSION

J. H. Beckwith, Miami, Fla.: I analyze this paper as a challenge to the exodontist to popularize an anesthetic that will please the public, and that cannot be given successfully by the general practitioner. I am a

great believer in nitrous oxide-oxygen as the anesthetic of choice in removing teeth, and have felt for years that we have not devoted enough study to its successful administration. I agree with Dr. McLaughlin that if we as exodontists are to command the business that our specialty justifies, we must spend more time educating ourselves and our patients in order to satisfy them with the merits of nitrous oxide-oxygen, so that a greater percentage of patients will demand the services of an exodontist. The following data were obtained from fifty-two questionnaires returned out of sixty sent to the leading dentists in Miami, Hollywood and Palm Beach, Fla.:

1. When referring patients to an exodontist, do you prefer the exodontist's using nitrous oxide-oxygen or a local anesthetic? 98 per cent answered: nitrous oxide-oxygen.

2. If your patients who require teeth removed are prejudiced against gas, do you explain the great difference between gas and nitrous oxide-oxygen? 32 per cent answered yes.

3. Do you think nitrous oxide-oxygen is safer and better, as regards the after comfort of the patient, than a local anesthetic? 70 per cent answered yes.

4. When patients are referred to an exodontist for the removal of teeth with nitrous oxide-oxygen, what is their objection, if any? 30 per cent answered that the fear of being unconscious, and the unpleasant experience and stories regarding gas, made them afraid.

5. Do you believe a dental surgeon is forced to work faster with nitrous oxide-oxygen than with a local anesthetic? 80 per cent answered yes.

6. What percentage of extraction cases do you refer to an exodontist? From 1 to 100 per cent, or an average of only 14 per cent.

7. If you or any member of your family were having a tooth removed by an exodontist, would you prefer nitrous oxide-oxygen or a local anesthetic? 96 per cent answered: nitrous oxide-oxygen.

8. Do you think wounds resulting from the removal of teeth heal more readily when nitrous oxide-oxygen is used than when a local anesthetic is used? 50 per cent answered yes.

9. Have your patients whom you have referred to an exodontist been satisfied with the use of nitrous oxide-oxygen? 97 per cent answered yes.

10. Do you feel that you have helped to build up a better practice financially; also, from the standpoint of your patients' confidence, in assuring them that since you want the best service possible for their comfort, it would be better for an exodontist to remove the teeth under nitrous oxide-oxygen? 95 per cent answered yes.

These data prove that 98 per cent of the dentists in Miami prefer to have nitrous oxide-oxygen given to their patients who are referred to exodontists. If they themselves were having a tooth removed by an exodontist, 96 per cent would prefer nitrous oxide-oxygen, but only 32 per cent take time to describe nitrous oxide-oxygen anesthesia to patients who are prejudiced against gas, and only 14 per cent of the extraction cases from the fifty-two dentists' offices are referred. If this is a fair average of all dental offices in the United States, it proves that we have failed as a whole in our specialty in not educating our patients regarding the merits of nitrous oxide-oxygen. Dr. McLaughlin's seven classifications and explanations based on experience with patients in his practice are excellent. For each classification, if followed through, with a little variation to fit individual cases, will aid in making patients react with confidence in nitrous oxide-oxygen. As to the innate revulsion to involuntary unconsciousness, Dr. McLaughlin lays stress on the inexperienced patient and children. I would like to add that the patients who have had the old form of gas given by the general practitioner respond satisfactorily if given a little more time in explanation. The sensations of suffocation or drowning, and the head noises, the accelerated and palpable heartbeat, are the unpleasant conditions that we and the skeptical patients dread. I find that a firm but kind explanation before the anesthetic is given helps to win their confidence. I use slow induction, with the mouth and nose piece, and the most important factor is to obtain an even flow of gases, never allowing a patient to reach the excitation stage from too much pressure or the sensation of suffocation caused from low pressure. I consider unpleasant dreams a reaction of the subconscious mind. The power of suggestion, employed as the patient is returning to consciousness, will leave pleasant memories of their experience with nitrous oxide-oxygen. As regards nausea, I disagree as to the efficacy of orange or any sweet odor around the mask. If we replace the masks often and keep them clean, there should be no unpleasant

odor. Excitability and combativeness have caused us all unpleasant experiences. With some patients, I have been using premedication with gratifying results. I agree with Dr. McLaughlin as to the value of quick induction and the use of restraining straps. But great precaution must be employed not to let the patient realize that the straps are being used.

Dr. McLaughlin: I have made it a point to say to the patient in the rest room, "What was your reaction?" Invariably, the reply would be gratifying, but occasionally a feeling of suffocation and head noise, but particularly the feeling of drowning, would be reported. We have not been questioning our patients often enough as to what is going on in their minds. If we are to think of the patient, should we put the nose piece on or the face mask? If it is well to use a nose piece, why is it not used in the hospital?

NORMAL DEVELOPMENT OF TEETH ASSOCIATED WITH ENFORCED DIETARY RESTRICTIONS AS THE RESULT OF CONGENITAL STRICTURE OF THE ESOPHAGUS

By LOUIS T. AUSTIN, D.D.S., and PORTER P. VINSON, M.D., Rochester, Minn.

A WELL-BALANCED diet and the inclusion in the diet of foods that bring into use the forces of mastication have been stressed as essential factors in the normal development of teeth. Although it is not the purpose of this report to minimize the desirability of these factors, we wish to call attention to the fact that an individual may develop normally in every way on a diet consisting largely of milk.

REPORT OF CASE

A man, aged 23, came to The Mayo Clinic for examination, March 10, 1930, complaining of difficulty in swallowing that had been present since birth. Until the age of 16 years, his diet had consisted almost entirely of milk, with the addition of cocoa and cream of wheat made into a thin gruel. At that time, an abdominal operation was performed with the idea of cutting a "kink" in the esophagus, and thereafter the dysphagia was relieved sufficiently to permit the ingestion of thin custards, a little candy and occasionally a cracker. Dysphagia was more marked when the patient contracted a cold, and he had had complete obstruction of the esophagus for as long as eight days at a time. In spite of this

Fig. 1.—Appearance of patient, showing good state of nutrition and of the teeth, although the patient's diet had been deficient.

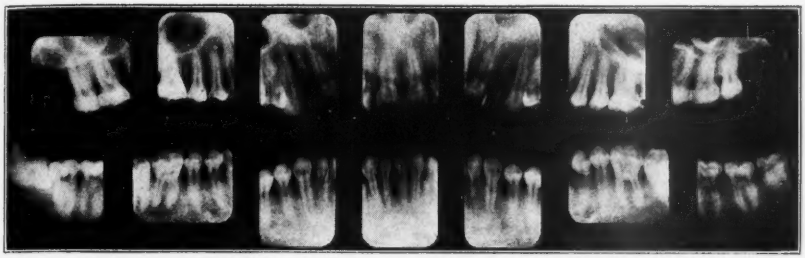

Fig. 2.—Dental roentgenograms. There is no evidence of caries.

Fig. 3.—Snap modeling compound impression. The teeth give no evidence of wear.

restricted intake of food, he had developed normally. (Fig. 1.) He was 68 inches in height, and weighed 149 pounds. He had always been very active physically and had been employed as a farm laborer. The day before he left his home to come for examination, he had driven fence posts all day with a 16-pound sledge hammer.

The general physical examination was essentially negative. It was noted that the patient's teeth were unusually good. (Figs. 2 and 3.) He had never consulted a dentist and had never experienced any difficulty with his teeth. Nine months before coming for examination, he had purchased his first toothbrush, but this had been used at infrequent intervals. The enamel of the teeth was unbroken, of good color and without any evidence of decalcification. The tissues of the gums were red with a mild degree of gingivitis. All teeth responded positively to the test for vitality. The patient's mother had lost all of her teeth and was wearing two full dentures, his father had poor teeth with a full upper denture, and a sister had numerous carious teeth with a few fillings, and

Fig. 4.—Congenital stricture in lower portion of esophagus.

several teeth that needed extraction. Another sister, aged 18 years, and a brother, aged 12 years, had good teeth.

Roentgenoscopic and esophagoscopic examinations revealed a congenital stricture of the esophagus 14½ inches from the incisor teeth. (Fig. 4.) The lumen of the stricture was 2 mm. in diameter and was easily dilated with a 43 French sound. After treatment, the patient was able to eat solid food for the first time in his life, and further roentgenograms revealed little evidence of esophageal obstruction.

The patient was dismissed March 27, with instructions to have further dilations of the esophageal stricture if dysphagia recurred.

MODERN LIBRARY PRACTICE

By JOSEPHINE P. HUNT,* Chicago, Ill.

DURING the past fifty years, library practice has undergone the same evolutionary changes that have taken place in almost every field of human activity or endeavor. Fifty years ago, practically every woman's clothes were made in the home. Most of the housewives of that period did their own canning and made their own bread, and even the light and the heat in the house were usually supplied and taken care of as individual units. Today our clothes are, for the most part, bought ready made. Many of them have been manufactured in quantity lots and they are, comparatively speaking, less expensive, yet they look better. Our canning is largely done in the factory, but there is less spoilage and the results are superior to those obtained when the work was done at home. Our light is, in most cases, supplied by some large public utility company, and, in many instances, our heat is likewise obtained from some central source. Evidences of labor saving methods are on every hand.

So with libraries, methods have changed. Years ago, a practitioner wishing to do extensive research on an obscure subject prepared to go into a library and spend a number of days going through the various indexes and individual volumes. As a result of his efforts, he might obtain something pertaining to his subject, but, on the other hand, he frequently found very little in which he was interested. The results did not justify the effort. This was not because of lack of diligence on his part, but primarily because of inadequate facilities for library research. Quite possibly, too, only a short time after this worker, this man who had spent days or even weeks delving into the literature, had left, someone else interested in the same subject might come in, but of the previous man's efforts, no benefits whatever remained. The entire search must be started and carried through again. Such antiquated methods are no longer tolerated and in present-day practice, such a waste of time and duplication of effort have been largely eliminated by the more modern ways which have come into vogue. Within recent years, many scientific organizations, such as the American Medical Association, the American College of Surgeons and the American Dental As-

*Librarian, American Dental Association.

sociation, and also commercial organizations, such as the Amercan Bakers' Association, have developed in their libraries a system whereby the research work is done largely by a librarian trained for this purpose, the information gathered becoming accessible not only to the inquirer who first was interested in the material, but also to all subsequent investigators in that field, all workers reaping the benefits of previous investigations. The exact methods used by these numerous up-to-date libraries vary somewhat, but the objectives and the results are the same.

In the case of the American Dental Association, this matter is taken care of by the so-called package library, a collection of clippings, reprints, etc., on some specialized phase of dentistry, which can be made to contain, time permitting, as exhaustive a collection of the literature as is necessary for the requirements of the case. To show how this plan of procedure works out in practice, an instance may be quoted: A dentist who has been very much interested for a number of years in the field of mottled enamel asked to have a package library and bibliography on this subject compiled for him. This was done, with much saving of time to him as well as convenience in the handling of the material found. The greatest benefit, however, was not to this research worker, who was already quite familiar with most of the literature on the subject, but to subsequent research workers, such as those connected with the United States Public Health Service, various universities and committees in communities where surveys of mottled enamel were being conducted. Each worker or group had not only the advantage of perusing everything which his predecessors had had access to, but also obtained the material in a form easily handled and with a minimum of effort on his own part.

To some a feeling of self-satisfaction may accrue in having spent some time pouring over certain dusty books in an effort to obtain, perhaps, a half dozen references to their favorite subject; but is greater benefit actually obtained from reading those articles after thus finding them than would be the case if they were forthcoming with little effort and in clean, convenient form? True, "there is no royal road to learning," but the fact still holds that a straight line is the shortest distance between two points, and it is difficult to see that the old fashioned roundabout method offers any advantages over modern library practice.

A number of years ago, in an article published in the "Dental Summary," by Arthur D. Black entitled "The Use of a Library," the following statement was made: "A library is valuable in proportion as it is used. If you have the most wonderful dental library in the world, it will be worth nothing unless you use it." This quotation might be paraphrased as follows and still be true: "A library is valuable in proportion as it is usable. If you have the most wonderful dental library in the world, it will be worth nothing unless it is usable." The American Dental Association has one of the smaller dental libraries in the country, but it is felt that the library is not only used but also usable. After all, it is not the size but the usableness that counts. A striking evidence of this fact was brought to mind by a letter received the other day from Washington, D. C., stating that after a search of three days in the Congressional Library for literature on the amount of force used in mastication, nothing had been found. It was stated that if any information could be obtained from the A.D.A. library, it would

be greatly appreciated. The desired information was not only obtainable, but was also immediately available without any effort whatever. Of course, it is not always that a request can be so easily filled.

In making these package libraries available, it was not intended to discourage individual initiative, but they do offer a nucleus around which additional information, collected by individual effort and experience, may be correlated.

In the announcement section of this issue, a comprehensive list of the subjects on which package libraries have been compiled will be found. Possibly among those listed, a package library helpful in solving your immediate problem may be included.

THE QUESTION OF THE DRY SOCKET

By H. J. SCHWARZ, D.D.S., St. Louis, Mo.

THE mere fact that there are a variety of opinions as to the etiology and treatment of the so-called "dry socket" indicates that its pathologic essence is but vaguely and loosely imagined. It seems useful, therefore, to attempt unveiling the mystery hidden under this popular term.

In my understanding, the "dry socket" should be defined in medical terms as a local necrotic condition of the alveolar process or its septum which, in the absence of blood vessels, can proliferate neither capillaries nor granulation tissue for the organization of the blood clot, and consequent healing. As the blood clot does not organize, it disintegrates and leaves exposed the bone, which, if not treated, likewise disintegrates until healthy osseous tissue is reached, then healing commences. Such a necrotic condition of a tooth socket may arise from any chronic inflammation of the pericementum and periosteum of a given socket, which, deprived of nutrition, emerges as a "dry socket" after extraction. Contrary to the interpretation of the majority of writers, the condition is created not after extraction, but before; and therefore all the means offered to preserve the blood clot as a remedy are futile.

Now from the medical definition of "dry socket" given above, the conclusion as to the method of therapeusis is very obvious. It must conform to that principle of surgery which requires every necrotic tissue to be removed, be it hard or soft. Hence, the radical treatment of a "dry socket" consists in surgical removal of the necrotic socket immediately after extraction down to the point where the osseous structure appears to have blood vessels; i. e., where it is not dry. The same procedure is to be followed when we deal with a case of "dry socket" after a previous extraction.

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Editorials

A TRIUMPH OF LEGISLATION

There has always been more or less difficulty in securing in the legislatures of the different states the passage of laws adequate for the protection of the people against abuses arising from the practice of those professions that are involved in the conservation of the health of our citizens. So many influences of an ulterior nature are usually lined up against constructive legislation of this character that it is a most discouraging task to secure the enactment of such laws as will most surely conserve the best interests of the commonwealth. But there has recently been passed by the State Legislature of Illinois a bill that must command the respect and admiration of every worthy citizen, not only of Illinois but of all states that have at heart the public welfare. In some respects this bill is in advance of any regulation heretofore enacted, and it is a matter for congratulation to all of those who were most instrumental in its passage.

The bill is, of course, too long for reproduction in its entirety at this time, but a few of its major provisions will suffice to indicate its general character. First is a definite statement as to what is meant by practicing dentistry. Section 5 of the bill says:

A person practices dentistry (or dental surgery) within the meaning of this Act, who represents himself as being able to diagnose, treat, remove stains and concretions from teeth, operate, or prescribe for any disease, pain, injury, deficiency, deformity, or physical condition of the human teeth, alveolar process, gums, or jaw, and who offers or undertakes by any means or methods to diagnose, treat, remove stains (and) *or* concretions from teeth, operate or prescribe for any disease, pain, injury, deficiency, deformity, or physical condition of the same, or to take impressions of the teeth or jaws; *or who owns, maintains or operates an office for the practice of dentistry; or who engages in any of the practices included in the curricula of recognized and approved dental schools or colleges. The fact that a person uses any dental degree, or designation, or any card, device, directory, poster, sign or other media whereby he represents himself to be a dentist, shall be prima facie evidence that such person is engaged in the practice of dentistry.*

Following this are the usual exemptions relating to such services as those of dentists of the Army, Navy, Public Health Service and Veterans Bureau in their official duties; dental schools in instructing students; clinicians from other states or countries attending meetings, etc.

One of the objections to some of our dental laws in the past has been the fact that they had no "teeth" in them to compel observance. In the new bill, the penalty for unlawful practice is stated as follows:

Any person who shall practice *or offer to practice* dentistry in this State without being registered or without a license for that purpose, or violates any of the provisions of this Act, *for which no specific penalty has been provided herein,* shall be subject to prosecution before any court of competent jurisdiction (upon complaint, information or indictment), and shall, upon conviction, be fined for the *first* (each) offense *by* (in) any sum not less than (fifty) *two hundred dollars* ($200.00) (($50)) nor more than (two) *five* hundred dollars (($200)), ($500), *and for each subsequent conviction shall be punished by a fine of not less than five hundred dollars ($500.00) nor more than one thousand dollars ($1,000), or by imprisonment in the county jail for not less than six months nor more than one year, or both so fined and imprisoned in the discretion of the court.* (All fines imposed and collected under this Act shall be paid to the Illinois State Board of Dental Examiners for its use.)

Two provisions of the recent act relate to corporate practice and advertising, and are as follows:

(Any association or company of persons, whether incorporated or not, who shall

engage in the practice of dentistry under the name of company, association or any other title, shall cause to be displayed and kept in a conspicuous place at the entrance of its place of business, the name of each and every person employed in said company or association in the practice of dentistry, and any one so employed by said company or association whose name shall not be so displayed as above provided, and the said association or company, if incorporated, or the persons comprising the same, if not incorporated, shall, for the failure to display the aforesaid names, be deemed guilty of a misdemeanor, and upon conviction thereof, each shall be punished as provided in this act.) *It shall be unlawful for any person or persons to practice dentistry under the name of a corporation, company, association or trade name; or under any name except his or her own proper name, which shall be the name used in his or her license as issued by the Department of Registration and Education; or to conduct, maintain, operate, own or provide a dental office in the State of Illinois, either directly or indirectly, or by his or her agents or employees; or for such person or persons to hold themselves out to the public, directly or indirectly, or through agents or employees as soliciting patronage or as being qualified to practice dentistry in this State; or to operate, manage or be employed in any room, rooms or office where dental service is rendered or contracted for, under the name of a corporation, company, association or trade name; provided, however, that any person or persons now practicing dentistry under any corporation, company, association or trade name may use his, her or their personal names as successor to the name now used for a period of two years from the time of the passage of this Act, at the expiration of which time the use of all corporation, company, association or trade names shall be discontinued.*

Any manager, proprietor, partnership, or association (or incorporation) owning, running, operating or controlling any room or rooms, office or dental parlors, where dental work is done, provided or contracted for, who shall employ, keep or retain any unlicensed person or dentist as an operator; or

Who shall fail, within ten days after demand made by the (secretary of the Illinois State Board of Dental Examiners), *Department of Registration and Education,* in writing sent by registered mail, addressed to any such manager, proprietor, partnership, *or* association (or incorporation) at said room, office or dental parlor, to furnish to said (secretary) *department* the names and addresses of all persons practicing or assisting in the practice of dentistry in his place of business or under his control, together with a sworn statement showing by what license or authority said persons are practicing dentistry, shall be guilty of a misdemeanor and subject to the penalties provided for in this Act: Provided, however, that such sworn statement shall not be used as evidence in any subsequent court proceedings.

Sec. 18a. No corporation shall practice dentistry or engage therein, or hold itself out as being entitled to practice dentistry, or furnish dental services or dentists, or advertise under or assume the title of dentist or dental surgeon or equivalent title, or furnish dental advice for any compensation, or advertise or hold itself out with any other person or alone, that it has or owns a dental office or can furnish dental service, dentists or dental surgeons, or solicit through itself, or its agents, officers, employees, directors or trustees, dental patronage for any dentist or dental surgeon employed by any corporation: Provided, that nothing contained in this Act shall pro-

hibit a corporation from employing a dentist or dentists to render dental services to its employees, provided, that such dental services shall be rendered at no cost or charge to the employees; nor shall it apply to corporations or associations in which the dental services were originated and are being conducted upon a purely charitable basis for the worthy poor, nor shall it apply to corporations or associations furnishing information or clerical services which can be furnished by persons not licensed to practice dentistry, to any person lawfully engaged in the practice of dentistry, when such dentist assumes full responsibility for such information and services. Any corporation violating the provisions of this section is guilty of a misdemeanor, and shall be fined not less than two hundred dollars ($200) or more than five hundred dollars ($500) for each offense, and each day that this Act is violated shall be considered a separate offense.

Sec. 18b. It shall be unlawful for any person, firm or corporation to publish, directly or indirectly, or circulate any fraudulent, false or misleading statements as to the skill or method of practice of any person or operator; or in any way to advertise to practice dentistry without causing pain; or to advertise in any manner with a view of deceiving the public, or in any way that will tend to deceive or defraud the public; or to claim superiority over neighboring dental practitioners; or to publish reports of cases or certificates of same in any public advertising media; or to advertise as using any anesthetic, drug, formula, material, medicine, method or system which is either falsely advertised or misnamed; or to advertise free dental services or examinations as an inducement to secure dental patronage; or to advertise any amount as a price or fee for the service or services of any person engaged as principal or agent in the practice of dentistry, or for any material or materials whatsoever used or to be used, or to employ "cappers" or "steerers" to obtain patronage or to exhibit or use specimens of dental work, posters, or any other media calling attention of the public to any person engaged in the practice of dentistry; or to give a public demonstration of skill or methods of practicing dentistry upon or along the streets or highways, or any place other than his office where he is known to be regularly engaged in the practice of his profession, and any person committing an offense against any of the provisions of this section, shall, upon conviction, be subjected to such penalties as are provided in this Act; provided, that any person licensed under this Act may announce by way of a professional card containing only the name, title, degree, office location, office hours, phone number, and residence address and phone number, if desired, and if he limits his practice to a specialty, he may announce it, but such card shall not be greater in size than three and one-half (3½) inches by two (2) inches, and such information may be inserted in public print when not more than one column in width and two (2) inches in depth; or announce his change of place of business, absence from, or return to business in the same manner; or issue appointment cards to his patients, when the information thereon is limited to matter pertaining to the time and place of appointment and that permitted on the professional card; or display the name of the licensee, on the premises where engaged in the profession, upon the windows thereof and by a door plate or name or office directory when the information is limited to that of the professional card. Provided, that the name and title of the registrant shall not be displayed in lettering larger than seven (7) inches; and be it further provided, that

nothing in this Act shall prohibit any person licensed to practice and inform the public in periods of economic stress and depression that his fee and price for dental services and examination has been reduced to conform with the reduced prices of commodities and services, provided that no statement of prices or fees is made.

The far reaching effect of this legislation cannot be overestimated, and we wish that it were possible to give due credit to every one of those who worked so loyally for the passage of the bill. It was a case of hearty cooperation on the part of the officers and members of the legislative committees of the Illinois State and the Chicago Dental societies, combined with the splendid aid given by the Administration at Springfield, and those members of the Senate and House who supported the bill so enthusiastically, among whom, it should be mentioned, were at least two dentists, Drs. Frank A. Stewart and Claude R. Thomas. When the final vote came, the legislature passed the bill by the overwhelming majority of 135 to 0, which was a larger favorable vote than that cast for any other measure during this session.

The clarification of our dental laws is a matter of the utmost importance, and we cannot but feel that a long and important step in advance has been made by the passage of this Illinois law.

GOLD AS A NECESSITY IN DENTAL PRACTICE

This editorial is prompted by a recent report submitted by Homer C. Brown, chairman of the Committee on Legislation and Correlation, and, in large measure, his statements are quoted. He says: "During the past several decades, gold has increasingly become the most important and dependable material employed in the practice of dentistry. Its use was greatly accelerated with the advent of the cast inlay and other similar restorations and replacements."

The volume of gold thus used has grown to very appreciable proportions, much of which is never returned to the channels of commerce as a circulating monetary medium. Thus, the recent tendency for hoarding gold, coupled with the general bank holiday, led the Government to take steps for gold conservation, the first of which was the gold embargo. When this was announced,

Dr. Brown sent the following telegram, March 7, to the President and the Secretary of the Treasury:

> As Chairman of Legislative Committee American Dental Association, I respectfully call attention to necessity for providing for withdrawal of adequate supply of gold to be used in practice of dentistry as health conservation measure. An estimate of amount necessary can be obtained from reports by manufacturers of dental gold.

Other influences were used to have the embargo removed, but it is reasonable to suppose that the plea for the conservation of health made the most effective appeal, and the embargo lasted only one week. Later, the Department, in its attempt to better control the gold situation, made a ruling wherein affidavits were required of gold purchasers for each three months' period. Also, the retail dental supply houses were required to keep a complete record of all sales for a definite period of time.

This seemed an unnecessary and irksome burden, for the reason that some dentists purchase supplies from more than one dealer, and each one would require a separate affidavit. Dr. Brown accordingly made a protest in the name of the American Dental Association, giving the facts and suggesting that the ruling be rescinded or at least modified. After considerable conference, on the part not only of our Association but also of others interested in the question, a modification has been made whereby only one affidavit will be required. This will declare that the gold purchased by the dentist shall be used in his practice, and this will cover all subsequent purchases, except where an unusual amount is required. In such case, another affidavit might be necessary, as well as some possible investigation. It would seem that the new ruling would conserve the interests of all concerned without working a hardship on anyone.

Dr. Brown has called attention to a statement of Dr. Philippe Hamel, president of the Canadian Dental Association, to the effect that they did not have a gold embargo in Canada, but that the government had placed a 30 per cent premium on dental gold, against which his association protested, and it is hoped that the protest will be effective.

There is one thing that should be emphasized in connection with

this and all similar questions, and that is the fact that, in the use of materials necessary for the successful practice of dentistry, the element of cost should be secondary to that of serviceability. In other words, to advocate cheap materials with the idea of saving money in the face of the very patent fact that these cheap materials are ordinarily not so reliable for the purpose of saving teeth as are other materials of known and demonstrated value is a poor, and it may be a pernicious, kind of economy. Any idea fostered in the profession or transmitted to the laity to the effect that gold must be displaced by cheaper materials in dental practice, when nearly a century of scientific and clinical experience has demonstrated the fact that, intrinsically, gold has qualities for tooth preservation superior to those of the cheaper products, is demoralizing in the extreme, and, if carried too far, it may easily lead to such damage as to eventually spell dental disaster.

The fact is that nowhere in the alchemy of nature has there ever been devised or discovered any material that is quite good enough to go in a human tooth or a human mouth. Cheaper materials indeed! when it is sufficiently known that the cost of dental care to the people is measured, as it should be, more by the time and skill required than by the cost of materials. Make the most extravagant estimate possible of the value of gold used by the dentists of the United States, and it will aggregate less than 50 cents per year for every man, woman and child in the nation. Should this be considered too much of a drain on the gold supply when the health of the people may through this medium be so surely at stake?

What about the amount of gold that is used for decorative purposes alone, for jewelry and other nonessentials of no intrinsic or welfare value? Would there not be greater logic in demanding that the consumption of gold for decoration be limited rather than to raise a question as to its use for filling teeth? But, in another view of the case, there need be little concern about the depletion of the gold reserve when the visible supply may be made to mount through better reclamation projects and the opening up of new mines. When the demand is sufficient, the supply will be forthcoming without question.

The government need never fear that the dental profession will be found lacking in cooperation with every worthy and necessary endeavor, but naturally it views with concern any restriction or regulation that places an unnecessary handicap on the use of a material as essential as gold in the rendering of adequate service to the citizens of our country.

With this as with many other essentials of our modern civilization, "The best is none too good."

THE SAVING GRACE OF EXPERIENCE

Now that the state boards have for the most part passed on the product of the dental schools for the current year, it may be profitable or at least interesting to consider somewhat carefully the problems presented to the recent graduates as they go out in the world to face the public through the medium of dispensing dental service.

The curriculum of the dental schools has apparently been elaborated to the highest degree. In the so-called practical and the so-called theoretical departments (just where the line shall be drawn between the "practical" and "theoretical" has never been quite apparent to some of us who have been engaged in educating students), the refinements of teaching have been brought to the greatest possible state of perfection, always considering, of course, the natural and ever-present limitations of human nature in both teacher and student. Of one thing there can be no question: the conscientious and earnest endeavor on the part of the large majority of our teachers to the end that the students may receive the benefit of the best possible training for their future alloted task of being dental practitioners.

Because, after all, the end and aim of all our endeavors in the training of students is to perfect them in the practice of dentistry. It is for this purpose that we spend five years of the developmental period of a student's life in preparation for this kind of career. Whether the period of five years is too short or too long is still a

moot question, with which we are not at this moment concerned, the point being that, in the allotted time, we are endeavoring to the best of our ability to perfect the product that comes to us. How well we are succeeding is another matter that might logically be subject to discussion, but at least the consensus of opinion would seem to be that we are doing a rather creditable job.

We are drilling students in the science and art of dentistry as they have never been drilled before; we are extending the curriculum till it has surely doubled in the last decade; we are delving in the fundamental sciences till certain of our students are complaining of weariness of mind and soul; we are demanding of them a technical training that is higher than that of any other profession, and, with it all, we are encouraging research that shall develop in them a certain spirit that has been too long lacking in our professional councils, but that today is showing such an awakening as has never been dreamed of up to this time.

Thus it would seem that, at least to a certain point, our graduates have been given the equipment to enable them to serve the people acceptably. If they discover a cavity in a tooth, they know how to fill it; if a natural tooth breaks off, they are able to construct a crown, and if one or more teeth happen to be lost, they have been taught bridgework or denture replacement. At first blush, the natural question might well be asked: "What more can be demanded of a graduate?" But there is more—a great deal more—and it is this that the recent graduate must acquire before he can be said to have achieved full stature as a well-rounded dental practitioner.

However skilful the graduate may be in meeting his technical problems, however well grounded in the fundamentals of histology, physiology or pathology, there remains the one essential without which he is unable to meet successfully all of the emergencies that come to him in every-day practice. The one thing needful to complete his equipment as a really successful practitioner is the very thing that his instructors in college can never teach him. However much they may apply themselves to further his interests, they can never impart to him that particular quality known as

experience. There are no rules to be applied to the teaching of experience, no formulated guide for him to study in textbooks or lecture courses, and very little that can be even remotely suggested by his instructors. To put it in the vernacular, it is up to him. For the first time in his professional activities, he is placed on his own resources as far as judgment is concerned. During all of his college course, those formative years, he has been leaning on his teachers for instructions and direction. Of a necessity, this is true, for the very simple reason that there was no other means whereby he might be guided in his earlier endeavors.

But this very proper and very natural impulse on the part of his teachers to come to his assistance at every turn has its disadvantages and it should have its limit. No matter how well the student may be trained technically or how many patients he may have served in college, the likelihood is that the very first patient that comes to his office after graduation will present a problem that the student has never met, and that he must perforce solve for himself. For the first time, he is developing real experience, and we trust is growing in grace.

Early in the student's career, the instructors should constantly aim to develop his student's judgment as to diagnosis and the best methods of performing technical procedures. In answer to the student's stock query to a demonstrator when a patient is in the chair, "Doctor, what shall I do?" the retort should invariably be, "What would *you* do?"

The aim should be to develop the student's thinking qualities, and to compel him to form opinions of his own. But those who know most about dental college work through long association with it know only too well how it all ends. In spite of the most laudable efforts to carry out such a program on the part of teachers and students, the net result is that students, to the very end of their college days, go on depending on their instructors for direction and help, and constituted as human nature is it cannot well be otherwise. Only when the student is finally cut loose from the protecting wings of his alma mater by graduation does he really begin to develop his judgment and initiative, and truly gain experience.

And it is only in the crucial alembic of trial and error in actual practice, or what is known as experience, that he finally emerges into that most satisfying haven of confident achievement, which, in the end, is translated into the thing that we call success.

Blessed be the student who in his early days applies himself to the fundamentals of his calling, and thrice blessed is he who, with this foundation, builds through experience a professional structure of symmetry and security.

AFTER THE JUBILEE

A jubilee is never misspent that is held to honor men who had vision. In the short review of seventy-five years, one sees that, in the near barbarism of pioneer days, a few seers previsioned the path that progress had to take. In the light of those visions, the Diamond Jubilee was attained.

When the last echo of the last trumpet has died, present realities take their place in our cosmos, tomorrow's perplexities claim our attention. Ultimately, the problem of leadership is the problem, if not of criticism of oneself, at least of recognition of patent weakness or occasions for concern. Wise men spend only minutes in celebration, but give hours and years to labor, and labor partakes of tasks easy and hard, of things that fall en route and of things that baffle and that refuse classification. We turn from old successes to new undertakings and to many not new that must still be confronted. Perhaps the thrill of the Jubilee will give determination to the attack and make us surer of victory. Nobody will question our triumphs; we must know where defeat may wait. It is idle to surmise what our forefathers would do with our difficulties; our difficulties are ours to bury or exalt us.

Our problems are obvious enough. One need be only slightly acquainted with our organization to hold his breath at sight of some of them. The question comes: Where is the mathematician to solve them? The regimentation of the body itself is a cause of wonder and worry. Wheels within wheels to threaten, purposes

and objectives organized but unsynchronized, with presidents and appended officials, sometimes enamored more of title than of trust; parts of a whole in appearance but of weakest liaison in reality. They form too often mere personalized units rather than a purposeful union. The explanation offered is that America is a political people; hence, the political appetite must be appeased. The reply might well be that we have all known a patriot's grief; hence, why mimic the folly, the weakness, the cost, the defeat of the national example?

Let us look at our schools. No one will gainsay that they form the cardiac center of professional life. Nor will any one concede that they have attained the heights expected of them, although they have had in medicine the best example possible of mistakes and how to make them. Like children refusing parental advice, they have sought to live their own lives, repeat the mistakes of their predecessors and learn by experience, as though that were the only way to learn.

Despite criticism, the schools have advanced. Slowly they have gained ground. For example, the infirmary seemed for years to defy organization, correlation. Dissociated from the studies of previous years, it was the place where a craft was substituted for the sciences, where the student learned his trade and forgot his attempts at what he deemed a useless scholarship. His instructors were the driftwood of the classes that had streamed through the college halls ahead of him. His objective was points and more points, his patient a mere thing for use in his workshop. No engineer had been able to build between the laboratories down stairs and the infirmary on the top floor a bridge that the student felt was trustworthy. But points as the final desiderata are giving way. Here and there, ground is being gained. Patients are now humanity in need. Some deans are demanding understanding of instructors and making it possible for capable men to fit themselves for their jobs. Diagnostic sense is in development. "Health service" is ceasing to be a perfunctory matin of easy speech and becoming a reality, though, speaking generally, it is still in process of becoming.

That is not all. Our educators are not at all sure how much

science a dentist needs to equip him for his destiny. He must be able to confer and even debate with his medical friends, maintain their respect and outargue them without raising his voice. Likewise, there are the soft-tissue diseases that can give a practitioner more sleepless nights than a prostrate market. How to make him adept in meeting these problems, ease his terror by expanding his judgment, give him a confidence that will thrive in the midst of his hard-tissue and mineralogic labor is a problem. How much orthodontia—any or none—shall be given? Defendents of both sides are found in high places. The man who must practice in the exile of the small town or village keeps the question perpetually alive.

Larger than the foregoing looms the issue of curricular years. How shall they be divided, two-three, one-four, five straight or two-four? And what of an internship? A man cannot gallop through the courses as they stand now and get lasting impressions of clinical pictures. Perhaps there are many ways of "writing tribal lays and every single one of them is right!" But who will say so or say which one? Who would dare enter the councils of education and give advice?

There is too the journalistic enigma. Directly and indirectly, dentistry supports between sixty and seventy journals. The same relation exists between some of them as holds between the ethical practitioner and an advertising parlor. Cynics say that the most ethical men at times fall wittingly or unwittingly for the temptation of mammon, and so would group the whole family of periodicals under a common accusation. Be that as it may, it is reasonable that a group of journals existing under a common professional patronage should keep step with the highest professional purposes. They should be pledged to the same idealism to which the profession is sworn. Whatever may have been the errors, the weaknesses of the past, pardonable like many sins in the light of the times, those errors will have to be corrected and abandoned. The cost is no part of the question, the ideal is irrevocable. If some drop by the way, unable to maintain their place, their graves may well afford the stepping stones of progress.

A trifle disturbing and to that degree unwelcome to our Jubilee filled minds come these issues and others to make their demands on our integrity of purpose and ability. If we ignore them, we give them strength and increase our own weakness. If we do not confront them, their accumulation can have but one result and that is prostration. T.

Obituary

EDWARD G. LINK, D.D.S.

(1861-1933)

Edward G. Link, nationally known as a dentist of rare skill and ability, died at the Strong Memorial Hospital, Rochester, N. Y., July 12, after a day's illness followed by an operation.

Dr. Link was born in Rochester and was educated in the schools of that city. He received his dental degree from the University of Pennsylvania, Department of Dentistry, in 1888, returning to practice in his home city. He was 72 years of age at the time of his death.

Dr. Link had held important offices in all the societies with which he was affiliated. He was a member of the American Dental Association, the Dental Society of the State of New York, the Seventh District Dental Society and the Rochester Dental Society. He was a member of the Delta Sigma Delta Fraternity. He had been a member of the Relief Commission of the A.D.A. since its inception and participated whole-heartedly in its activities. It was in part his friendship and influence with the late George Eastman that led to the founding of the Rochester Dental Dispensary, the success of which in furnishing a greatly needed dental service has since led to establishment of similar dispensaries in many foreign countries.

During the World War, Dr. Link served as state director of the Preparedness League of American Dentists. He was a member of the Rochester Art Club, the Rochester Club, the Rochester Historical Society and the Humane Society. His interest in art and his artistic taste were reflected in the furnishings of his office, the rugs, carvings, paintings and antiques having been gathered in many foreign lands.

Dr. Link is survived by several nieces and nephews.

EDWARD G. LINK, D.D.S.
(1861-1933)

BUREAU OF PUBLIC RELATIONS

THE PERIODONTIST LOOKS AT CHILDREN'S DENTISTRY

By JOHN OPPIE McCALL,* D.D.S., New York City

THE contribution of dentistry to the welfare of the general population is usually considered as lying chiefly in the realm of the prevention of caries, and this, in turn, is usually visualized as being concerned chiefly with the mouths of children. When we think of the dental needs of the community or that section of it which has reached the period of adolescence or maturity, we are apt to forget the preventive phase, and give more attention to the relation of established dental disease to the degenerative dental disorders grouped under the heading of focal infection.

We give too little thought to the possible relationships between these two apparently divergent concepts regarding dental service. The dentist who is interested in focal infection is likely to center his attention on this and give little thought to the fact that the foundation of much oral focal infection is laid in childhood and in neglect of the child's teeth. On the other hand, the man who is interested in preventive dentistry or what we might more accurately call children's dentistry is thinking usually of filling cavities and removing stain. He usually gives but little thought as to how he may plan his efforts to the end that the child may grow up to have a set of teeth so arranged in their relations to each other that they may most readily be protected from both caries and periodontoclasia, particularly the latter. I see here, especially, a job for the periodontist and urge that he be brought into future school and preventive programs.

Possibly the most effective way to emphasize the need for this is to describe some of the conditions, as observed by a periodontist, in the mouths of the children of today living in a large city. It is hardly to be wondered at that dentists not especially interested in periodontia should give their chief attention, when studying the mouths of children, to the striking facts of existent caries. When one looks into the mouth of a child and sees numerous cavities of decay of various size and hears of toothache and the formation of abscesses, it is but natural to have one's attention focused on these things to the almost complete mental obliteration of the observable but little considered gingival disturbances. This is also to be readily understood in view of the fact that advanced periodontal disease is extremely rare in the mouths of children, such lesions as are observed seeming to be quite superficial in char-

*Director, The Murry and Leonie Guggenheim Dental Clinic.

acter. The fact remains that gingival disease is quite as common as caries in the mouths of children. It is thus evident that when such lesions are found, some defensive element is lacking, and that the groundwork is already laid for a later severe and possibly intractable disease of the supporting tissues of the teeth.

It may be of interest from this standpoint, as well as from the standpoint of the consideration of caries in children's mouths, to give some of the figures on the latter type of disease as observed at the Guggenheim Clinic. From the time of the opening of the clinic to Jan. 1, 1933, a period of about two years, nearly 9,000 children were admitted. The children are examined in a department set aside for that purpose and are given an examination not only by exploration and inspection, but by the roentgen rays as well. The latter aid, universally used, has demonstrated itself to be an essential part of the examination procedure. An inspection of the throat is also made by the dental examiner, who records gross deviations from the normal. An estimate is also made of the child's general condition as indicated by his color, the expression of the eyes, the character of muscle and the fleshy development of the arms. The latter examination, as well as that of the throat, is expected to be chiefly suggestive as to the possible need for more particular medical examination.

Taking the figures for 1932, we find that of 4,600 new patients examined, only 117 were free from caries, a percentage of approximately 2.5. The ages of these children ranged from 1 to 14 years. We have become accustomed to thinking that from 90 to 95 per cent of public school children are subject to caries. When we find this figure approaching 97.5 per cent, we see the threat of universal caries. It is obvious that as age increases, caries increases also, as the larger number of children free from caries will lie in the younger age groups. I have not made a study to determine at what age caries becomes universal, but this can be arrived at indirectly by following the curve established by the increase in caries in the earlier years.

At the Guggenheim Clinic, an effort is made to register as many preschool children as possible in the district served by the clinic. The following figures give a striking demonstration of the increasing liability to caries with increasing age, the latter of course being related to the length of time the teeth are in the mouth, a seemingly important consideration.

2 years (thirty-four patients).
41 per cent free from caries.
32 per cent from one to six cavities.
27 per cent, seven or more cavities.
Largest number of cavities in one patient, seventeen.

3 years (151 patients).
17 per cent free from caries.
42 per cent from one to six cavities.
41 per cent, seven or more cavities.
Largest number of cavities in one patient, twenty.

4 years (361 patients).
9 per cent free from caries.
36 per cent from one to six cavities.
55 per cent, seven or more cavities.
Largest number of cavities in one patient, thirty-one.

Remember that while the incidence of gingivitis is not directly associated with the incidence of caries in all cases, it is at least as prevalent, the difference being in the degree of severity of the disease found. While in many instances the occurrence of gingival disturbance may be traced directly to the occurrence of caries, it may also be found in parts of the mouth where there is no caries; but it is rare to find gingival disease in a mouth in which there is no caries.

This, of course, is at variance with the usual finding with regard to the relationship of these diseases in the adult mouth.

Several types of gingivitis are found in the mouths of children. Perhaps it would be more accurate to state that gingivitis is found to occur under varying conditions, the nature of the gingivitis itself showing considerable clinical similarity regardless of the conditions which seem to bring it about. I am speaking now of what I call localized gingivitis. The generalized type is a definite entity and should be considered as quite distinct from the localized type, being, as would be expected, a symptom of systemic involvement.

Localized gingivitis is found, for instance, when proximal caries has provided an opportunity for the impaction of food against the gingivae. This occurs in the posterior regions only. An observation which I do not recall having seen in the literature and which is important in this regard is that the spacing of the deciduous teeth which occurs as the jaw grows, providing for the accommodation of the larger permanent successors, does not usually occur between the deciduous molars, or between the deciduous second molars and first permanent molars. Here, proximal contacts are maintained up to the time of the shedding of the deciduous teeth, thus affording protection for the proximal gum tissue during the heavy mastication of coarse food, which is naturally a requisite for alveolar development. The occurrence of proximal decay in this region permits food impaction, the sequential incidence of gingivitis and, because of the tenderness so produced, partially inhibits masticatory function. This is a striking relationship and one of the greatest importance.

Traumatic occlusion is, of course found in the mouth of the child very frequently. Traumatic occlusion in the permanent dentition is very commonly traceable to premature extractions or extensive caries in the deciduous teeth. These are quite as important causes as early loss of the first permanent molar. If the decidous teeth are not lost prematurely and are kept filled, traumatic occlusion rarely develops in that dentition, or, in fact, in the permanent dentition. More and more, I find myself thinking of the problem of preventing periodontoclasia in the permanent dentition as having its groundwork in preventing traumatic occlusion, and of the prevention of this condition, in its turn, as being founded on the preservation of the anatomic form and dimensions of the deciduous teeth. The establishment of full function with its effect on jaw development and its general hygienic influence on the oral tissues is, of course, correlative with the prevention of traumatic occlusion.

Traumatic occlusion is responsible, in many cases, but not in all, for the development of gingivitis. Very commonly this, when it does occur, is associated with recession of the gingival margin and with shallow pocket formation. In some instances, owing perhaps to superior tissue tone, the gingiva, instead of developing a congestive gingivitis, assumes a hypertrophic condition, showing itself in a decided thickening of the gum margin without any considerable redness. Traumatic occlusion, if severe, may bring about mobility of the tooth, but pocket formation is absent or is very shallow. Pocket formation of any depth is very rare in the child's mouth. When found, it is usually associated with severe traumatic occlusion. On the other hand, I have seen one

child, a negro girl of 8 years, who had deep pockets on all of the deciduous molars, in which case the element of traumatic occlusion was present in but slight degree.

From the standpoint of treatment, we find a striking fact brought out, i. e., that the establishment of mouth cleanliness, the restoration of function and the stimulation of the gingivae by vigorous toothbrush massage have a remarkably beneficial effect. It is interesting to note that of these three agencies, the most important is the restoration of function, the next being toothbrush massage. In fact, it might almost be said that the toothbrush massage is the most important of the three. This is particularly exemplified when traumatic occlusion is found and cannot be relieved. I appreciate the fact that when stressing toothbrush massage, I am also stressing cleanliness, which will naturally be achieved in the course of the massage. On paper, it is not easy to make a distinction, but clinical observation indicates that there is such a distinction and I regard it as important that this should be brought out.

I am deeply interested in the problem of diet as a factor in the dental welfare of the child, but I realize that our knowledge in that field is still incomplete. Pending the time when we have exact knowledge and the still more remote time when we may, through educational efforts, bring about the widespread application of that knowledge, I wish to state that local care both by the dentist and at home can accomplish a surprising amount of good, and I also wish to state that the necessary dental care, if undertaken at an early age and maintained with regularity, need not be excessively expensive. It may well be undertaken, I believe, as a community health measure for all who cannot afford private dental care.

ACTIVITIES AND OBJECTIVES OF ORAL HYGIENE IN NEW YORK STATE

By C. D. VAN ALSTINE,* D.D.S., Albany, N. Y.

THE activities maintained and the objectives established are the fundamental criteria of our program of oral hygiene in New York State. These criteria are not a recent development. They have gradually evolved with the program. Properly, they may be regarded as the terminal products of practical administration. Activities are essential to the growth or development of a program. It is an adult activity program. The educational functions of it are end-products. The dental hygiene teacher works with both school and home.

THE PROGRAM

History.—In New York State, oral hygiene teaching, in common with other educational services, is a state function. Its adoption, as such, dates from Dec. 7, 1910, when Eugene H. Porter, then commissioner of health, appointed two dentists as lecturers on oral hygiene. The services rendered by these two dentists in the schools were found to be so valuable that they were in great demand.

*Supervisor of oral hygiene, State Department of Education.

Two more dentists were added to the staff at the expiration of the first year. Demands for their services from schools of the state increased so rapidly that, at the end of the second year, a full-time lecturer on dental hygiene was appointed by the state commissioner of health.

This instructional oral hygiene service to school children was continued by the state health department until July 15, 1914. It is still carried on among children of preschool age.

A law providing for school medical inspection in the public schools in the state was passed by the legislature in 1913. Its provisions did not apply to New York City, Buffalo and Rochester, where the work was organized and administered by the local board of health. The new law authorized the employment of dentists and oral hygienists by boards of education. Early in the program, hundreds of dentists in the state designated children's dental hours for school children.

Appreciation of the value and need of better dental service rapidly grew, until 1918, when a full-time state supervisor of oral hygiene was appointed in the state education department. Since then, or for fifteen years, this position has continued and oral hygiene work in the schools has grown rapidly.

Objectives.—Primarily, the work of the oral hygiene teacher is educational and, as a part of the school system, her services are in the nature of a demonstration. Individual instruction stressing the reasons for and need of a clean mouth while the demonstrator is actually cleaning the teeth of a pupil has been found to be very effective.

Though many parents and children look on dental care as a semiluxury, their lack of appreciation only emphasizes the school's responsibility of properly informing them, but not in assuming their burden.

It should be realized that no fixed or rigid policy or standard of procedure can be established in all schools alike. Programs are limited by local conditions, economic situations, the attitude of parents and the home environment.

Activities.—Oral hygiene instruction is not a separate school program. It is or should be integrated with other educational activities. There should be a systematic plan of cooperation and correlation with the entire school system. The pupil's dental health should be the paramount objective, around which the oral hygiene program should function.

Oral hygiene teachers should inspect the teeth of school children and chart the findings. Parents should be promptly notified of conditions needing attention and advised to consult the family dentist. These teachers should make home calls and explain to the parents the importance of the care of the teeth, especially of the first permanent molars. Instruction as to the foods necessary for building good teeth should be discussed at this time.

Certification.—To enable school authorities throughout the state to employ hygienists qualified to carry on the work, definite postgraduate qualifications were established by the state department of education.

"Dental supervisor" is the official designation for a dentist employed as a supervisor. The only qualifications are a state license to practice dentistry and annual registration with the state board of dental examiners. No certificate is issued for this position.

"Dental hygiene teacher" is the official designation for a dental hygienist employed in school health service and who meets certain qualifications.

Permanent certificates are issued only to applicants who are high school graduates, and who are registered in New York State as dental hygienists. To be qualified for a certificate, the applicant, in addition, must present "credentials showing completion of at least twelve semester hours' work in approved professional courses in health education and two years' successful experience as a dental hygiene teacher."

The following courses approved by the state education department as meeting the requirements can be taken at approved colleges, universities and state normal schools: introduction to education, sociology, psychology of childhood, health education in elementary schools, child development, principles of health education, mental hygiene, behavior problems of children, educational psychology, spoken English, nutrition and poster work.

Limited certificates are issued to dental hygienists who present credentials showing completion of at least six semester hours' credit in approved professional courses in health education, as above enumerated, and are valid for three years.

Rural Schools.—From the inception of oral hygiene service in schools, the state dental society has taken an active interest in this service. To demonstrate its usefulness, the oral hygiene committee of the state society popularized the employment of hygienists in many rural schools in the state. It employed the first hygienist to work in the schools in the fall of 1922. The schools paid $25 a week for her services. During the first year, six schools employed her for approximately seventy-three days during the school year. During the school year 1925-1926, 400 days of similar service was rendered to 6,400 children, while from May 1, 1930, to May 1, 1931 42,367 children were examined and 40,053 were given prophylactic attention by the twenty-one dental hygienists then employed through the committee of the state dental society. Their services during this time were rendered in 519 schools.

City and Village Schools.—In 1926, there were forty dental hygienists teaching oral hygiene in the schools in New York State exclusive of those in New York City, Rochester and Buffalo. In 1930, there were 125 employed, an increase of 320 per cent in four years. In a recent survey of the work as now conducted in the schools, the superintendents were found unanimous in its approval and were a unit for its continuation and extension. Dental hygienists here are carrying on various types of programs, including full-time clinic assistance, full-time prophylactic service, school inspections, toothbrush drills, conferences and talks before various civic organizations. Various projects, such as poster making and the writing of dental health plays, stories, songs and essays are correlated and adopted to the grade in which they are used.

Material has been prepared by the department for the use of teachers and pupils consisting of the following leaflets:

Baby Teeth and the Six Year Molars.
Procedure for Toothbrush Drill.
Dental Hygienist Cabinet Drawing.
Regulations Governing Dental Hygiene Teachers.
Dental Reference Notice.
Notification of Parent.
Monthly Report Blank.

Modern oral hygiene, properly integrated in the health service of our educational system, is already making its contribution to better health, better attendance and scholastic advancement.

THE IOWA PLAN FOR DENTAL HEALTH EDUCATION PROMOTED BY THE BUREAU OF DENTAL HYGIENE, STATE UNIVERSITY OF IOWA, 1932-1933

By C. L. DRAIN,* D.D.S., Iowa City, Iowa

FUNDAMENTALLY, the Iowa plan is carried on as an educational program, stressing: (1) prevention, (2) education and (3) correction. It is promoted by the bureau through the personnel of the schools of Iowa, which includes school superintendents, teachers and nurses. It has been demonstrated that, on the classroom teacher, rests the greatest responsibility for the success of dental health educaton. We have endeavored to assist these leaders through the following services: correspondence, teachers' institute work in thirty-five counties, distribution of Iowa Plan literature, provision of films and slides and of publicity and parent education material, field visits to schools for individual conferences and group meetings.

During the present school year, the Iowa Plan for Dental Health Education is being used in the rural schools of eighty counties and approximately 400 towns, reaching about 200,000 pupils. The teachers have stressed mouth hygiene and the importance of proper foods in their health lessons. It has been somewhat difficult to urge dental corrections as forcefully as in past years because of the present financial situation. Nevertheless, the bureau has received favorable reports regarding dental corrections, interest in regular visits to the dental office and the cooperation of community organizations (congress of parents and teachers, Christmas seal sale committees, clubs, etc.) assisting in the care of needy children. In the rural as well as urban communities, there has been a marked improvement in the cooperation of school, home and dental profession. The teachers present the facts, children acquire dental health knowledge and more parents appreciate the value of preventive measures tor mouth health. The Iowa dentists have endorsed the plan, have given examinations to all pupils bringing a school notification card and have supplemented the school's aim in the educational phase. In addition, much reparative work has been done.

To assist the teacher in presenting this program to her pupils, the following material is furnished: (1) instruction sheet for pupils; (2) bulletin, "The Care of Children's Teeth"; (3) wall poster, "Good Health and Good Teeth"; (4) classroom dental honor roll, and (5) notification card for every pupil.

The bureau awards a special certificate, bearing the seal of the university, to any classroom that secures a complete return of notification cards by the pupils from their dentists. Approximately 350 of these have been issued this school year.

Including the preschool child, age from 2 to 6 years, in the health program offers a wonderful opportunity to strengthen the work of prevention. Cut down dental troubles in this group and half the problems that ordinarily arise after the child enters school have been solved. Several Iowa organizations are now actively committed to such a program, and our commonwealth may con-

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fidently look forward to far-reaching results where their leadership is followed by the local parent-teacher associations, women's clubs, farm bureaus and school organizations.

The bureau suggests the following plan of action regarding this group:

1. Include the preschool child in all publicity, especially urging attention to this age group.
2. Distribute the following free leaflets and bulletins, obtainable from this bureau, to parents: "Building Baby's Teeth" (No. 223); "Your Teeth" (No. 221), and "The Care of Children's Teeth" (No. 289).
3. Initiate a friendly competition between classes or rooms to see which can secure the largest number of signed "preschool notification cards."
4. Send a green "preschool notification card" to all parents of such children in the local school district and in those tributary to it. (These cards are furnished free.)

We are publishing a bimonthly *"Dental Messenger"* for county superintendents in which we attempt to give suggestions that may be passed along to teachers, pupils and parents. A similar bulletin containing items of interest to town superintendents is published at regular intervals.

One project which we are carrying on this year, and which we feel will be of considerable assistance to the program, is the assembling of a teacher's manual, more especially designed for the rural teacher. This is being done by a very competent teacher under the supervision of the Department of Education and the bureau. This work, we believe, will give the bureau a more definite educational standing, which is essential to perpetuation of a program of dental health education.

THE IOWA PLAN FOR DENTAL HEALTH EDUCATION; RESULTS FOR FIVE YEARS

Towns and Cities	1927-1928	1928-1929	1929-1930	1930-1931	1931-1932
No. towns ordering supplies	58	60	241	415	464
Enrollment in such schools	35,432	35,011	78,868	125,000	159,903
No. towns reporting results	?	53	150	300	340
Enrollment in such schools	?	35,799	62,296	117,242	114,183
No. pupils on dental honor roll	?	17,077	30,367	63,588	61,575
Percentage	?	50.5	48.9	54.2	53.9
No. 100 per cent towns	?	?	4	8	9
No. 100 per cent rooms	?	?	147	413	426
Rural Schools					
No. counties ordering supplies for rural schools	11	11	40	68	83
Enrollment in such schools	16,567	16,567	65,911	101,345	123,867
No. counties reporting results	?	8	37	66	75
Enrollment in such schools	?	12,596	51,056	65,479*	61,855*
No. pupils on dental honor roll	?	5,874	15,704	39,026	25,427
Percentage	?	46.6	30.7	59.6	41.1
No. 100 per cent rural schools	?	?	227	508	459
Total enrollment, active towns and rural schools	?	46,395	113,352	182,721	176,038
Total pupils on dental honor roll	?	22,951	46,601	102,614	87,002
Percentage for entire group	?	49.4	40.6	56.1	49.4
Total 100 per cent rooms and rural schools	?	?	374	921	885

*This enrollment is based upon the rural schools that reported one or more dental corrections. It is therefore not quite comparable to the former reports.

COUNCIL ON DENTAL THERAPEUTICS

FANTĀZN NO. 1—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

Inquiries have come to the Council concerning Fantāzn, put out by the Fantāzn Laboratories, Los Angeles, Calif.

Fantāzn No. 1 on the label is stated to be:

Topical Anaesthetic for the MUCOUS MEMBRANES OF THE MOUTH. Antiseptic, Odorless, Tasteless, Non-Narcotic, Non-Toxic, Non-Irritating and No After Effect.

Other advertising claims it to be:

A Powerful Harmless Local Anaesthetic For Dental Surgery.

The advertising received by the Council plays on the pain associated with dental operations. It is claimed to be "The Most Successful Anaesthetic for Dental Surgery" and it is stated that "it accomplishes in full what other local anaesthetics accomplish only in part—a complete and lasting insensibility to feeling and to any depth necessary."

In order to give the proprietor an opportunity to express the composition of this "most successful anaesthetic for dental surgery," an inquiry was made of them almost two years ago, as to whether or not the product was secret, and if not, whether they would care to submit a statement of the composition. Acknowledgement of this communication has not been received.

Accordingly, Fantāzn No. 1 was examined in the A.D.A. Bureau of Chemistry. The report follows:

FANTĀZN NO. 1

Two (2) original packages of Fantāzn No. 1, price $1.50 (Fantāzn Laboratories, Los Angeles, Calif.) were received for examination.

The following appeared on the label:

Fantāzn No. 1. Topical Anaesthetic for the mucous membranes of the mouth. Antiseptic, Odorless, Tasteless, Non-narcotic, Non-toxic, Non-irritating and No After Effect.
Fantāzn Laboratories—4374 West Third Street, Los Angeles California.

Each bottle contained approximately 15 c.c. (½ fluid ounce) of a light yellow liquid possessing a slight aromatic odor. The solution became cloudy when cooled below room temperature (approximately 15 degrees C.) and crystals separated at a lower temperature. The specific gravity was 1.065 at 20 C. and the refractive index was 1.479 at 20 C. A small amount ignited on a platinum crucible cover burned with a smoky flame, leaving no residue.

Elementary qualitative organic analysis indicated the presence of nitrogen. Halogens and sulphur were not found. The liquid was miscible with alcohol, ether and chloroform. It was partially soluble in water, with the precipitation of a

white substance in considerable quantity. The precipitate was soluble in dilute acids and insoluble in water and dilute alkalis. Recovered from ether, its melting point was 89-90 C. (uncorr.). Qualitative tests indicated that it was ethyl aminobenzoate (benzocaine). A mixed melting point with an authentic specimen of ethyl aminobenzoate showed no depression.

The aqueous filtrate yielded an oily liquid of which approximately five-sixths boiled at 194.5 to 196 C. (corr.). Elementary qualitative analysis indicated the absence of nitrogen. Qualitative tests indicated the absence of phenols, acids, aldehydes, ketones and esters. The presence of a hydroxyl group was indicated. The liquid was miscible with water, alcohol and ether. The specific gravity at 20 C. was 0.986 and the refractive index at 20 C., 1.427. The substance possessed a slight aromatic odor. The properties agree essentially with those reported for Carbitol[1] (diethylene glycol monoethyl ether).

Quantitative examination yielded: ethyl aminobenzoate (crude), 33.8 per cent.[2]

From the foregoing, it may be concluded that a mixture having the essential properties of Fantāzn No. 1 may be prepared by dissolving one part of ethyl aminobenzoate in two by weight parts of Carbitol.[3] A mixture thus prepared had a specific gravity of 1.064 at 20 C. and a refractive index of 1.482 at 20 C. The color, odor and solubilities of the mixture were practically the same as for Fantāzn No. 1.

(End of Chemist's report)

From the chemist's report, it is apparent that Fantāzn No. 1 presents little originality, and that dentists and physicians are being asked to use a well-known local anesthetic under a meaningless proprietary name.

The firm also markets a second anesthetic, Fantāzn No. 2, and Gan-Aiden. Gan-Aiden appears to be another name for a solution of ethyl aminobenzoate sold to physicians.[4]

The uses of ethyl aminobenzoate in dentistry are well known. Many formulas are available for the application of this drug for anesthesia by absorption through the mucous membrane. It has been prescribed in the form of powder, in the form of an ointment and in the form of a solution. The claim that it is a "most successful anaesthetic for dental surgery" is too unwarranted to require comment.

Fantāzn is declared not acceptable for A.D.R. because the composition is not made available to dentists (Rule 1); it is advertised with unwarranted therapeutic claims (Rule 6); the name is not expressive of the composition, and the firm is not entitled to a proprietary name for a mixture of well-known substances (Rule 8).

1. Carbitol is the trademarked name for the commercial solvent diethylene glycol monoethyl ether, manufactured by the Carbide and Chemicals Corporation. Carbitol is not a pure substance, but is stated to contain not less than 90 per cent diethylene glycol monoethyl ether. The properties of Carbitol are given in the booklet "Synthetic Organic Chemicals," Ed. 4, p. 15, published by the Carbide and Chemical Corporation.

2. Nitrogen in another specimen of Fantāzn was determined and found to be 2.54 per cent (average of two determinations), equivalent to 29.9 per cent ethyl aminobenzoate.

3. The Carbitol was obtained directly from the Carbide and Chemicals Corporation, Carbide and Carbon Building, Chicago.

4. J.A.M.A., 99:1863 (Nov. 26) 1932.

PALS IMPROVED REDUCIBLE SILVER, PALS IMPROVED ACONITE AND IODINE, PALS BENZOCAIN COMPOUND, PALS GUM BALSAM, PALS PYORRHEA ASTRINGENT NO. 1, PALS PYORRHEA ASTRINGENT NO. 2, AND PALS SURGICAL POWDER—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary*.

PALS IMPROVED REDUCIBLE SILVER[1]

Pals Improved Reducible Silver was presented to the Council as an improved preparation on the original silver preparation of Percy R. Howe, by Dr. B. L. Paley, Brooklyn, N.Y. It was claimed that "the improved method consists of the addition of anesthetic agents, (oil of cloves and creosote), glycerin for its hydroscopic properties which give it the deep penetration and sulphonates which stabilize the mixture. "In view of the claimed advantages of the added ingredients to Dr. Howe's original preparations, statements of the amounts of these added drugs should have been supplied. A statement of composition or method of preparation was not furnished. Dr. Paley presented no evidence to indicate the advantages of Pals Improved Reducible Silver over many of the preparations of this kind readily available.

The Council declares Pals Reducible Silver inadmissible to A.D.R. because it cannot recognize the right of the firm to a proprietary name for an unessential modfication of a well-known preparation, and a statement of composition for the product is not furnished.

PALS IMPROVED ACONITE AND IODINE

Pals Improved Aconite and Iodine, according to Dr. B. L. Paley, Brooklyn, N.Y., has the following composition: iodine crystals, 4 per cent; zinc sulphocarbolate, 2 per cent; fl. ext. capsicum, 2 per cent; fl. ext. aconite, 5 per cent; belladonna leaves, 10 per cent (solid extract is used in proportion); benzyl alcohol, 2 per cent; acetone, glycerin, water and essential oils for flavoring. It is stated to have the advantage over plain aconite and iodine for deep penetration owing practically to the non-alcoholic vehicle besides its synergetics, which help a great deal.

As such, the preparation essentially represents a shotgun mixture of antiseptics, counterirritants and local anesthetics. It is stated to have an advantage over plain aconite and iodine, but evidence for the statement is not presented. In any event, the dilution of tincture of iodine with an equal part of tincture of aconite, largely

1. Since this report was adopted by the Council, an examination for the silver content of Pals Reducible Silver was carried out in the A.D.A. Bureau of Chemistry. A percentage of 16.3 silver was found, in place of the 28-32 per cent required for a solution of ammoniacal silver nitrate prepared according to Howe's directions. (J.A.D.A., 20:530 [March] 1933.)

used in dentistry, serves no useful purpose, for the tincture of aconite merely dilutes the iodine solution. Dr. Paley does not make clear the particular synergetic action which he claims for his solution.

Pals Improved Aconite and Iodine is presumably intended for direct sale to the public. The Council desires to point out that the sale to the public for indiscriminate use of a mixture containing tincture of aconite and iodine cannot be considered in the public interest. The use of potent drugs should be in the hands of those equipped by training to use and prescribe them.

The Council declares Pals Improved Aconite and Iodine inadmissible to A.D.R. because it represents an unessential and unscientific modification of well known drugs, and the most promiscuous sale of a product containing tincture of aconite for self-medication by the laity is potentially harmful. The Council cannot recognize the firm's right to a proprietary name for a mixture of well-known pharamacopeial drugs.

PALS BENZOCAINE COMPOUND

Pals Benzocaine Compound, according to Dr. B. L. Paley, Brooklyn, N.Y., contains as principal ingredients: benzocaine, 10 per cent; apothesin or procain HCl, 1.5 per cent; balsam of Peru, 5 per cent; carbon tetrachloride, 30 per cent, and a vehicle of essential oils, acetone and olive oil q.s. 100 per cent. As such, it represents a mixture of well known local anesthetics in a complex medium, and any therapeutic effects ascribed to the preparation may be due to the benzocaine (ethylaminobenzoate, U.S.P.X) and either procaine hydrochloride or apothesine.

No evidence was submitted in favor of using two local anesthetics, both of which have specific effects on the sensory nerves or their endings, in one mixture. Benzocaine belongs to the group of slightly soluble local anesthetics, which renders them unsuitable for injection, but their slow absorption renders them safer for inducing local anesthesia by absorption from the mucous membranes, and is thus used after dental operations. Apothesine and procaine hydrochloride, on the other hand, belong to the type of local anesthetics which, while effective for injection anesthesia (when combined with epinephrine), are relatively inefficient when applied to mucous membranes. The mixture of active medicinal ingredients in Pals Benzocaine Compound therefore is irrational.

The Council declares Pals Benzocaine Compound inadmissible to A.D.R. because it represents an irrational mixture of active local anesthetics, which offers no advantage over either drug alone, and because it is marketed without a statement of composition.

PALS GUM BALSAM

Pals Gum Balsam, according to Dr. B. L. Paley, Brooklyn, N.Y., has the following formula: iodine and methyl salicylate, aa 5 per cent; zinc sulpho-carbolate, 2.5 per cent; fl. ext. of myrrh and fl. ext. of capsicum, menthol and camphor, as 2 per cent, and a vehicle of alcohol, 22 per cent, fixed and volatile oils, soap, sulphonates and water to make 100 per cent. It is a preparation "for the relief of acute and chronic pericementitis and bleeding gums."

The formula as given above is not strictly quantitative and is of a shotgun nature. The tendency of modern medication is to use drugs on the basis of their indi-

vidual action, whether for local or for systemic treatment. No evidence has been furnished as to the value of this preparation over other simple counterirritants which may be used for the temporary relief of pain due to pericemental disturbances. Pain due to pericemental disturbances is a condition which is best treated by removal of the underlying cause as far as possible, and requires diagnosis and care of a skilled dentist. The statement on the label: "An auxiliary treatment for various forms of inflammation, congestion, pain and infection of the gums" is in conflict with Rule 4 of the Council, which states: "No article will be accepted if the label, package or circular accompanying the package contains the name of diseases or conditions in the treatment of which the article is said to be indicated." The Council holds that naming of diseases or conditions on the label or circular tends toward indiscriminate self-medication by the laity.

A statement of the amounts of the active ingredients does not appear on the package and the name "Pals Gum Balsam" is not framed so as to indicate the potent constituent. Indeed, the name appears to be a misnomer in that it might be interpreted to mean that the product contains "balsams" which are resinous in character.

The claim in the circular that "Pals Gum Balsam is indicated whenever there is pain or discomfort of the gums or teeth whether from sensitiveness or soreness as in most cases of neuralgia of the gums, pyorrhea, cutting of children's teeth, in pregnancy, or of periodical pains in the mouth" is unwarranted as these conditions require individual care and expert diagnosis.

The Council declares Pals Gum Balsam inadmissible to A.D.R. because it is marketed without a definite statement of composition (Rule 1); no tests for identification are furnished (Rule 2); therapeutic indications are given on the label, tending to potential harmful self-medication (Rule 4); unwarranted therapeutic claims are made (Rule 6); the principal label does not give a statement of the content of iodine, a potential poison (Rule 7); the name is objectionable as it does not indicate the important ingredient of the mixture, and it represents an unscientific article and is thus inimical to the best interests of the public and the dental profession.

PALS PYORRHEA ASTRINGENT NO. 1

Pals Pyorrhea Astringent No. 1, according to Dr. B. L. Paley, is made up as follows: iodine crystals, 5 per cent; tannic acid, 25 per cent; acetone, glycerine and water q.s. 100 per cent. It therefore essentially represents a solution of iodine and tannic acid in a complex medium. Iodine and tannic acid are well known drugs and both have been used for a long time in dentistry, the former as an antiseptic and counterirritant and the latter as an astringent. Thus, the preparation represents a mixture of drugs with different pharmacologic actions. It also represents a pharmaceutic incompatibility in that tannic acid when treated with iodine undergoes a series of complex changes resulting in the formation of hydrogen iodide and compounds from tannic acid which are precipitated. No evidence was presented of the usefulness of this preparation over many of the formulas for "pyorrhea astringents" available in textbooks and formularies.

The Council declares Pals Pyorrhea Astringent No. 1 inadmissible to A.D.R. because it represents a mixture of well known drugs for which no evidence was

presented to show its usefulness over readily available agents for inducing astringency in so-called pyorrheal conditions, and it is a mixture of drugs marketed under a therapeutically suggestive name. The Council desires to point out that therapeutically suggestive names are not in the interests of the profession and the public. The use of drugs in modern therapeutics should be based on the effect expected from drugs rather than on names which are suggestive of diseases or conditions.

PALS PYORRHEA ASTRINGENT NO. 2

Pals Pyorrhea Astringent No. 2, according to Dr. B. L. Paley, Brooklyn, N.Y., is made up as follows: copper sulphate, 15 per cent; Monsel's solution, 10 per cent; boric acid, 3 per cent; glycerin and water q.s. 100 per cent. Pals Pyorrhea Astringent No. 2 is therefore an aqueous-glycerol solution of copper sulphate and ferric subsulphate to which boric acid has been added. Both copper sulphate and ferric subsulphate (in the form of Monsel's solution, solution of ferric subsulphate N.F.V.) have been used to induce astringency in the treatment of periodontoclastic diseases and their use has been known to dentists for long periods. It further represents a mixture of two astringents. No evidence has been offered as to the effectiveness of this solution over either one of these active agents alone.

The Council declares Pals Pyorrhea Astringent No. 2 inadmissible to A.D.R. because it represents a mixture of well known pharmacopeial drugs for which the Council cannot recognize a proprietary name.

PALS SURGICAL POWDER

Pals Surgical Powder, according to Dr. B. L. Paley, Brooklyn, N.Y., has the following composition: apothesin or procain HCl, 3 per cent; balsam of Peru, 10 per cent; thymol iodide, 3 per cent; essential oils, charcoal and kaolin q.s., 100 per cent. It is stated that the charcoal and kaolin act as absorbents for the odors and secretions.

Pals Surgical Powder is one name applied to a mixture of medicaments which may have either apothesin or procaine hydrochloride present at different times. This arrangement of the proprietary name, for a remedy that may possess more than one composition, can hardly be accepted as being in accord with rational therapeutics.

Whether apothesin or procaine hydrochloride is present, the product is unacceptable because it is essentially a mixture of readily available drugs marketed under a name noninforming as to composition. The Council cannot recognize the firm's right to a proprietary name to a dosage form of well-known drugs.

The Council declares Pals Surgical Powder inadmissible for A.D.R. because it is not of constant composition; and because it represents essentially a dosage form of well-known pharmacopeial drugs for which the Council cannot recognize the firm's right to a proprietary name.

STYPTYSATE—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

Styptysate is marketed by Ernst Bischoff Company, New York City, as a "dependable non-toxic hemostatic." Advertising to dentists states it to be

. . . indicated in hemorrhage control. Prophylactically, wherever a tendency to bleeding is suspected or known to exist. Before complicated by hemorrhage. Also in Uterine, Gastric, Renal, Nasal and Pulmonary hemorrhages and even true Hemophilia. In dysmenorrhea its analgesic action is very pronounced.

It is supplied in liquid and in tablet form; it may be administered orally or topically. Shortly after the War, Styptysate was advertised to the medical profession with the following claims:

The Remedy for Hemorrhages . . . Superior to Ergot and Hydrastis . . . of particular advantage in Menorrhagia and Metorrhagia . . . found of great value in vesical hemorrhages and hemorrhages from mucous membranes in general.

The Council on Pharmacy and Chemistry in 1922 examined the available evidence for the product and found it not acceptable for N.N.R. The best that could be said for the product was that, during a shortage of ergot in Germany in wartime, it was used in place of that established drug. (Styptysate, Not Admissible to New and Nonofficial Remedies, J.A.M.A., 78:450 [Feb. 11] 1922.)

This appraisal of the product is further borne out by a review of the Quarterly Cumulative Index Medicus and the Quarterly Cumulative Index from 1918 to 1932 (April). While several references on Styptysate and Shepherd's purse (the plant from which the product is made) appeared in 1920 and 1922, none appeared after 1922. It thus would seem that a little used drug already generally discarded by the medical profession is resurrected and advertised to dentists.

According to recent advertising Styptysate is a "dialized (sic) fluid Extract of Capsella Bursa Pastoris," which "reduces both clotting and bleeding time without increase of blood pressure as it is purely hemic in action." No statement of composition other than "Dialysate of Capsella Bursa Pastoris" . . . Alcohol, 14 per cent." "Non-narcotic hemostatic" appears on the package. Capsella bursa pastoris is commonly known as Shepherd's purse.

The following appears in advertising:

In the revised edition of his work, *A Textbook of Exodontia,* Dr. Leo Winter writes as follows: "In addition to packing the socket, hemostatics should be administered internally. Of the numerous hemostatics offered to the profession a most effective one has recently claimed our attention. The drug is a dialyzed fluid extract of Capsella Bursa pastoris, marketed under the trade name of STYPTYSATE. It is not a vasoconstrictor, so does not raise blood pressure. Bleeding time and clotting time are both greatly reduced and remain so for about twenty-four hours."

Before consideration of the product was taken up in June of 1932, communications were sent to the firm inviting them to place before the Council a statement

of source and preparation of the product; a statement of the active ingredients, as far as possible in quantitative terms; chemical or physiologic assays for controlling the uniformity of the product and any carefully controlled experimental evidence, laboratory or clinical, as to the usefulness of the product in dental practice. A representative of the firm promised to send this information, but although nearly twelve months have passed, the information has not been received.

Dr. Winter was requested to make available to the Council the scientific or carefully controlled evidence upon which the statement accredited to him rested, and asked if the firm had his permission to quote from his textbook. Sometime later, after a second letter was sent, Dr. Winter wrote in part as follows:

Dr. Newcomb, describing himself as a representative of the Bischoff Company, came to see me at the clinic and told me that they were manufacturers of Alpha-lobelin and other approved preparations and that they were desirous of my experimentation with a new product for the control of bleeding.

My procedure in this case was the one which we follow generally: first, ascertain the standing of the concern; second, inquire as to whether or not animal experimentation has been done with the product; third, attempt to determine the basic ingredients in order that we may not produce an irreparable injury on human being. Being satisfied with Dr. Newcomb's statement in this regard, we proceeded to try it and found that when applied locally, Styptysate did seem to have an action which appeared to be equally as good as Adrenalin Chloride 1:1000 or Suprarenin. No controls were used in the experimentation of the drug for the reason that no case presented itself out of the 100 or more upon which it was tried where we had the same character of bleeding on both sides of the mouth that would enable us to see which of the drugs was most effective. My statement was merely to the effect that Styptysate was another drug which could be used in the control of persistent capillary oozing, and I did not desire to have it given any further meaning.

The illustration which appears in my textbook was only a part of a gracious act and due to the persistent calling of this individual. Not seeing any possible detrimental action, I acceded to his request. This was not based upon any commercial arrangement with the Bischoff Company for I have none, nor with any other concern.

In this connection, it is an interesting fact that not one of the preparations of the Ernst Bischoff Company, New York City, stands accepted in the latest edition of New and Nonofficial Remedies, published by the Council on Pharmacy and Chemistry of the American Medical Association. The grounds on which the representative of the firm claims that they market approved preparations is not known. Therefore, the following is presented for the information of the dental profession:

Shepherd's purse is a weed common in the United States and in Europe. Like most other common plants, it was formerly used in domestic medicine. Shepherd's purse does not receive extensive consideration as a hemostatic from authors of standard textbooks on materia medica, pharmacology and therapeutics.[1] It has not been extensively studied, either chemically or pharmacologically. The active constituents, if any, are ill-defined, variable and uncertain. Its action also is indefinite and uncertain. Investigators attribute some of its effects on strips of excised uterus to the potassium salts present, others to "bursic acid" and still others to the presence of fungi. Kochmann, whose investigation represents the most critical yet cursory

1. Sollmann (Manual of Pharmacology, 4th ed. p. 483) lists it as an oxytoxic of minor importance. Myer-Gottlieb-Henderson (Experimental Pharmacology, Ed. 2) devotes a few lines to it for its action on the uterus and the literature cited contains no evidence of a hemostatic action on this organ, the results on excised strips being controversial and irrelevant.

work on the weed, finds that it causes contraction of the excised uterus, but the activity of the drug collected at different periods yields different results, and he points out the need for further investigation of the drug with reference to place, time of harvesting, method of drying, etc.

The articles in support of its use as a hemostatic for menorrhagia and uterine hemorrhage are uncritical and do not furnish enough data for critical analysis.[2] The drug, at best, cannot possibly compare in effect with ergot or pituitary.

It is probable that at one time Styptysate may have contained cotarnine, to which it may have owed its styptic effect, if any. It is improbable that cotarnine is now contained in the preparation; otherwise, a narcotic blank would be required for its purchase. Cotarnine is being generally discarded as a uterine hemostatic. It actually increases the flow of blood.

No evidence is available that Styptysate is efficient as a blood coagulant or hemostatic when administered orally, that it is useful locally or that it possesses advantages not obtainable with epinephrine or readily available inorganic hemostatics or thromboplastic agents.

In view of the foregoing, Styptysate is declared inadmissible to A.D.R.; because its composition is semi-secret and indefinite, there is no evidence that its uniformity and strength are controlled (Rules 1 and 2), the therapeutic claims advanced for its use in dental practice are unwarranted (Rule 6) and no evidence has been advanced that it occupies a useful place in the control of hemorrhages when other useful drugs are available (Rule 10, essentially useless articles).

2. Walther: Capsella Bursa Als Secelersatz, Med. Klin. 622 (June 17) 1920. Kroeber: Ueber Capsella Bursa Pastoris L, Muenchen. Med. Wochenschr., 67:752 (June 25) 1920. Oppenheim: Styptysat, Ein Neues Uterinum, Med. Klin. 902 (Sept. 2) 1920. Report of Council on Pharmacy and Chemistry, J.A.M.A., 78:450 (Feb. 11) 1922.

CURRENT LITERATURE

Roentgenograms the Property of the Physician (J. A. M. A., June 17, 1923): In a legal episode in which a dentist was involved, the dentist advised that a roentgenogram be made to aid in diagnosis and treatment. A dispute between dentist and patient arose over the fee, and the patient refused to pay the cost of the roentgenogram, whereupon the dentist sued for his fee. The facts were stated and the question of the ownership of the films was involved. Judgment was rendered in favor of the dentist. As far as is known, no appellate court of last resort has passed on the question. The case decision follows: "The determination of this question involves the question of whether the x-ray film is a chattel subject to be bought and sold on the same basis as any other chattel. The court is of the opinion that an x-ray film is not a chattel in the sense that it can be bought and sold. When a dental surgeon or a physician makes an x-ray of a patient he is required to have certain equipment in his office and to that end he purchases the x-ray machine itself and in the making of an x-ray film for a patient he pays for the material that goes into the making of said x-ray film or picture, and when said film or picture is produced it becomes a part of the record of that particular case and a part of the equipment of his office; said x-ray film or picture is of service and value only to the dental surgeon or physician who has knowledge and training in diagnosing the particular case and is a part of the record of that particular case and of value in giving said dental surgeon or physician enlightenment in the treatment of said case. In the making and reproduction of an x-ray film for a patient the dental surgeon or physician sells and the patient pays for, not the material that goes into the x-ray film but for knowledge and experience. It is a fundamental proposition that the law will not make an implied agreement to transfer ownership of an x-ray film or picture from the person producing it to the patient in the absence of an express agreement to the contrary. In this case there is no testimony that there was an express agreement to transfer ownership of the x-ray film from the plaintiff to the defendant. The plaintiff testified that it is customary that such films be retained by the person who has taken them. The court is of the opinion that the retention of said films by the person taking them is necessary as a part of his record concerning the case; retained on the same basis and on the same theory that a surgeon retains his temperature chart that he has made, or other record concerning the diagnosis or treatment of a case; and that as a matter of law it must be said that where x-ray pictures are taken under circumstances such as they were taken by the plaintiff in this case, there is no implied undertaking to turn those films over to the patient. The court is further of the opinion that the protection of the person taking said films depends largely on the proper preservation of the same and such films should remain with said dental surgeon or physician. The interpretation is the all-important thing in connection with an x-ray examination. The film itself is simply the basis of the interpretation."

T.

Detailing the Dentist for his Prescriptions (A. O. Mickelsen, J. Am. Pharmaceut. Ass'n, June, 1933): Mickelsen asserts that it is necessary that care of the patient be directed by the dentist. Instead of medication being directed by the dentist, the patient is instructed to purchase some drug or patent preparation and treat himself. The preparation is passed on by patient to patient and the circle of self-medication is enlarged. The author quotes from a label the common assurance that the preparation "is safe, does not harm the heart and will not upset the stomach." It is "non-narcotic and nonhabit forming." Medication of this sort is neither sound nor professional and disregards injury to public health because the quotations are not true. Medication, to be of value, must be as specific as possible, the amount taken being predetermined; which can be assured by a prescription.

T.

Dermatitis Due to Nupercaine (S. J. Fanburg, J. A. M. A., Jan. 7, 1933): After de-

scribing nupercaine, giving its formula and mentioning its uses, Dr. Fanburg reports a case. Use of nupercaine ointment to stop the itching of a persistent eczema on the dorsal surfaces of the feet was followed by an erythematous vesicular eruption, with swelling and pruritis of the feet, legs, thighs, arms and neck, which was thought due to poison ivy. When the condition cleared up, contact tests gave a strongly positive reaction to nupercaine. The nupercaine ointment was not used thereafter and the skin condition improved.

T.

Structure and Development of Marsupial Enamel (C. E. Allen, Australian J. Dent., Feb. 1, 1933): Allen discusses with numerous illustrations the development of marsupial enamel, which he asserts is formed identically as is human enamel. He concludes that enamel is a mesodermic tissue, in contradiction to all previous conclusions and teachings. He gives three proofs: 1. The finished enamel exhibits an identical structure, with the fibrillar network which was originally contained in the connective tissue cells bordered by the original connecting fibrils which form the so-called tubules of marsupial enamel. 2. The cells can be seen moving up from the stellate reticulum and becoming incorporated in the tissue which is laid down prior to enamel formation. 3. Any oval or circular outlines seen in enamel are identical in size and structure with the original embryonal connective tissue cells. Calcification, he asserts, appears to commence at the periphery of the oval cells and progresses inward. Columnal epithelial cells are not mineralized, but embryonal connective tissue cells act on a collogenous or gelatinous lymph derived from the vessels of the pulp in such a way as to mineralize it. The author concludes that the enamel-forming apparatus is not defunct, but still exists, although highly mineralized, and is still associated by the fibrils described with the lymph supply of the tooth.

T.

Foreign Literature

Is the Pathology of Dental Caries a Problem of Dentistry or of Medicine? (A. Beretta, Rev. Belge d. Stomatol., December, 1932): Professor Beretta asserts that our ignorance in this matter today leaves the dental caries problem a grave one and impossible of a rational and efficacious prophylaxis. In a careful statement, he arrays the arguments of the vital or nonvital enamel in its submission or reaction to decay with the proponents of each theory. He further asserts the need to consider the chemicoparasitic theory of Miller and the later trophomicrobic theory in the light of clinical observation. He gives five conditions of enamel decay: 1. Caries always begins in the enamel. 2. All carious processes have their origin at a point of retention, but points of retention do not all give rise to decay. 3. All individuals are not attacked equally by decay, but rather show individual predisposition. 4. All teeth are not attacked on the same surface. 5. Caries presents frequently at given times in the life of an individual. Whatever theory is accepted must satisfy these conditions. After seven years of experiment and observation, he concludes that the trophomicrobic theory more nearly stands the test of clinical observation. In conclusion, he declares that two problems confront stomatologists in their research: the physiology of enamel and the physiology of saliva.

T.

Roentgenographic Diagnosis of Paradentitis (G. A. Sedginidse, Ztschr. f. Stomatol., 1932, p. 1546-1564): The primary pathologic change in paradentitis consists of the aging of the bone tissue and of the alveolar processes and expresses itself in the form of resorption. The latter is aggravated by the inflammatory process, which is active in the bone as well as in the soft oral tissues. Pyorrhea alveolaris represents a type of paradentitis in which the inflammatory processes involve the bone tissues as well as the oral mucosa. The roentgenograms afford the opportunity to diagnose the initial stages before the clinical symptoms appear. The histologic studies show that, even in the early stage, which is recognizable in the films, there is already an inflammatory infiltration of the soft tissues of the paradentium. Various methods of treatment of pyorrhea alveolaris may remove the signs of inflammation for some time. The fundamental degenerative process in the bone tissue continues. The author presents the following classification: I Paradentitis incipiens (recognizable only by roentgenograms). II Paradentitis—advanced form: 1. Exudative pyorrhea: a. With gingivitis. b. Without gingivitis. c. With pocket formation. d. Without pocket formation. 2. Nonpyorrhoica-sicca (Cruet): a. Without changes in the oral mucosa. b. With changes in the oral mucosa and the denuding of the tooth roots. The author regards paradentitis as a

disease of a definite system (chiefly the bone system) and makes a plea for a more frequent and more careful use of the roentgenograms as a means of diagnosis.

I. S.

Pathologic Changes in the Oral Cavity in Blood Diseases (F. Laband, Vierteljahrsschr. f. Zahnhlk., 1931, p. 47): The diseases of the hemapoietic system show typical changes in the oral cavity. These are of value as early symptoms or as diagnostic factors. They include Hunter's glossitis and stomatitis, extensive ulceration, spontaneous necrosis of the oral mucosa and spontaneous bleeding. These symptoms may be found in leukemia, agranulocytosis and lymphomonocytosis. In all cases which present such symptoms without any local cause and in which the patient gives the impression of severe illness, one must think of the possible presence of a blood disease. The final analysis of the disease in question is given by the blood picture.

I. S.

Root Treatment in Living Pulp (Bernhard Gottlieb, Bálint Orbán and Georg Stein, Tijdschr. v. Tandheelk., May, 1933): Histologic research on dog's teeth with treated roots is the most important control method available to determine the value of proposed new methods of root canal treatment. The reasons for this are manifold. Several points of view are discussed from which the treatment of wholly, or partially, vital pulps are considered. In cases of accidental pulp exposure (by trauma, the use of the drill, etc.), the particles or slivers of dentin introduced into the pulp are united by a hard substance. Prognosis is better in younger patients. If the root is not completely formed, the pulp should be saved at all times, and the irritation of this treatment will stimulate the root to completion of its formation. In cases of pulp extirpation, the best results are obtained with hydrogen peroxide, while under local anesthesia, and the root canal filling is made immediately thereafter. This produces no necrosis or other bad results, but promotes healing of apical and lateral canal wounds. It is important to fill the canal completely, but not to overfill. No chemicals are used to dry the canal, only cotton. Experimental histologic experience indicates that a cement root canal filling which can be pressed to place with a spiral broach gives the best results. Cement is mixed with powdered dentin from extracted noninfected human teeth. This increases the tolerance of the apical tissues to cement and produces cementum and bone formation without irritation to the other tissues. The good microhistologic results observed from this method are not present when other materials are used. No objections to this method are observable from the results. Control experiments on dogs completely confirm these claims. No final conclusion is available as to preference between human dentin powder and ivory powder, which is much easier to obtain. If the apical foramen is not penetrated, other materials can show equally good results (cement-dog's dentin, cement-pig's dentin, chloropercha-thymol, Albrecht's paste). The cement is introduced wtih a spiral broach, first soft, then thicker and followed with a blunt guttapercha point to push the cement to a close contact with the apex. As a rule, the filling is made at the same sitting.

F. VAN M.

Harmlessness of Amalgams, Especially Copper Amalgams (G. A. H. Eibrink Jansen, Tijdschr. v. Tandheelk., April, 1933): A detailed analysis is given of all evidence produced to prove the inaccuracy of Professor Stock's conclusions that amalgam is harmful to the human body. The researches of Souder and Sweeney of the Bureau of Standards (U.S.A.) are quoted to prove the nontoxic effect of amalgam in every respect. Their calculations and experiments are reviewed in detail, particularly as far as they relate to the possible release of mercury from silver or copper amalgam fillings. Their conclusions were that no evidence of a toxic effect could be found. The researches of Borinski and others of the Chemical Institute at Berlin are similarly reviewed, including exact measurements of the effect of mercury upon fifty-two children after the placing of amalgam fillings. Their conclusion is that regardless of the form in which mercury is introduced into the human body, or by what channels, it is eliminated unchanged through the kidneys and intestines. After a few months, there is no difference between the quantities of mercury from those carrying amalgam fillings and from those that do not. A résumé is given of the advantages of copper amalgam over silver amalgam.

F. VAN M.

MISCELLANY

BOOK REVIEWS

Medicine for Dental Students. Edited by H. A. Lucas, Vice-Dean King's College Hospital Medical School. Published by William Wood and Company, Baltimore.

This book was written by "members of the teaching staff" of King's College Hospital Medical and Dental Schools. There are eleven chapters with sixty-eight subheads, the total comprising 199 pages. Very simple mathematics will show how much information is imparted on each of the sixty-eight subjects mentioned, and likewise give an excellent but startling idea of the estimate the authors put on dentistry. The book savors of the old compend days of questions and answers, when unrelated fragments sufficient to pass a compend-supplied board of examiners was all that was thought necessary for dental practice. Education is not a part of the process. The authors do not seem to conceive that memorizing proverbs never made a man wise. The first paragraph of the preface says: "This book has been written with two objects in view: to secure a textbook of medicine to meet the special needs of dental students and to cover the new schedule in medicine for dental examinations." Seven of the eight contributors are medical men, possessed apparently with the long-out-grown idea, in this country at least, that only a smattering of information is good enough for dentists. Outline books are undoubtedly the rage today for shortcutting in culture of all sorts, but medicine and dentistry are not acquired in that way. One can only imagine what the specially trained teachers of university dental schools, doctors of philosophy and doctors of medicine or both would say when offered this text. And dentists whose educational needs are measured by it will say more. The book is beautifully bound, being typical of the output of William Wood and Company; but books, unfortunately for their binders, are not valued by scholars for their covers. T.

Ground Porcelain Inlays. By William Dall. Published by Henry Kimpton, London. This book is a posthumous publication, the content having been developed in 1911. The printing was ordered by the author's widow under the council and advice of Sir Frank Colyer. The workmanship of the book is the very best, paper, binding, type and cuts. It is copiously illustrated. Unfortunately for general sales, the methods of inlay making described in it have been succeeded years since by the platinum matrix method. The value of the book lies in the painstaking, infinitely laborious care manifested by the author in his directions for accurate results from this manner of filling. As a record of one of dentistry's experiments in esthetic repairs, the book deserves highest commendation. T.

Books Received

The Duties of Ohio Public-Health Commissioners. By W. W. Charters and Darwin A. Hindman. Published by the Ohio State University, Columbus, Ohio.

CORRESPONDENCE

Minute on Report of the Commission on Medical Education

To the Editor: At a recent meeting of the Dental Educational Council of America the Council adopted the following minute relative to the final report of the Commission on Medical Education and the secretary was instructed to send you a copy thereof:

"The Dental Educational Council of America has given special attention to the comment on dentistry on pages 216-217 of the *Final Report of the Commission on Medical Education* (December, 1932). Included in the Commission's comment is the expressed opinion that "dentistry should be developed under medical education." No reasons for this intended subordination of dentistry are given excepting the general opinions that (*a*) "It would seem logical"; (*b*) "would be consistent with university principles which no longer recognize the artificial separation of fields of knowledge"; and (*c*) "would go far toward establishing a highly desirable and valuable correlation of the professional training of these two closely related fields of practice" (medicine and dentistry).

"These suggestions for the subjugation of the dental profession are neither impressive nor persuasive. To the Dental Educational Council, cognizant of the related facts in the history of both medicine and dentistry, the proposed development of dentistry *"under"* medical education, in the United States, (*a*) would seem to be illogical; (*b*) would be inconsistent with university principles which clearly recognize the public necessity for the self determination of, and for appropriate differences in education for, the various professions; and (*c*) instead of correlating the professional training in medi-

cine and dentistry, would degrade one profession for the exaltation of the other, and also demoralize the service of the practitioners thus dishonored.

"There should be intimate *coordination* between the ***principles*** and procedures of education for medical practice and for dental practice. Although remaining *independent*, these two forms of health-service education should be made more closely *interdependent* for the betterment of each. The *Council and the dental schools have long promoted this mutual helpfulness*. The strengthening of this constructive educational development, in the public interest, appeals to us as a far more important *interprofessional objective* than the relegation of one profession to a position of enforced inferiority. For the attainment of this worthier purpose, we pledge the cordial interest and effective cooperation of the faculties of the dental schools in the United States."

Sincerely yours,

ALBERT L. MIDGLEY, *Secretary*.

OHIO'S PAST PRESIDENTS' EMBLEM

By J. V. GENTILLY, D.D.S., Cleveland, Ohio

Nestled in a valley in Southern Ohio, not far from the home of John Harris, the father of American dental education, rise a cluster of three mountains in the Mt. Logan Range, which marks one of the historical settings of the State of Ohio. A design of this setting, with the rising sun in the background and a sheaf of wheat and a bundle of seventeen arrows in the foreground, constitutes the great seal of the State of Ohio. Every state in the union has adopted a seal which represents some historical feature of that state. The seal when embossed on parchment or legal tender indicates that an organization for the protection of the public welfare will enforce the execution of the purpose for which this seal is used and is recognized in all states and countries.

The past presidents' emblem of the Ohio State Dental Society, which is in the form of a pendant charm, was conceived for the purpose of recognizing and honoring those persons whose interest in and service to the organized dental profession has been associated with altruistic motives. This emblem is made of 14 carat gold with raised figures and letters. The face of the emblem carries the seal of the State of Ohio, and in the circle around the seal are the raised letters "Ohio State Dental Society." In the arch above is the date 1866, the year the society was organized, and on the base in raised letters is the name of the recipient of the emblem, a past president of the state society. On the reverse side in the arch above are the words "Constituent of" and in the circle "American Dental Association." Within the circle, also in raised letters, is the phrase "Dedicated to Dental Progress and Fraternalism" and on the base are the two significant words in Dentistry "Prevent — Preserve."

At the conference in Chicago, in January, 1932, of the officers of the state societies with the officers of the A.D.A., Dr. Aufderheide, then president of the Ohio State Dental Society, proposed the adoption, by the various states comprising the American Dental Association, of a past presidents' emblem of uniform design. He illustrated his talk with drawings and lantern slides of the proposed design with sketches of the seals of different states.

Past presidents' emblem of Ohio State Dental Society.

The purpose of uniformity in design and construction is that men may recognize by the emblem those who have served their profession similarly. Modern life is so complex, its demands so multiple, that an individual, no matter how gifted or energetic he may be, can no longer function efficiently alone, but must collaborate with others of his calling, and, in this alliance, find heartening strength in the fellowship of those who are engaged in like problems. It is this spirit that brings progress to our profession. For this reason was the design proposed.

The Tennessee State Dental Society has adopted this emblem, which is manufactured by the Dorst Company, of Cincinnati, Ohio.

To those states where a past presidents' emblem does not exist, Ohio submits the design herein illustrated, with the hopes that when a past presidents' emblem is proposed, this design will be carefully considered.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association in conjunction with the Chicago Centennial Dental Congress, Chicago, Ill., August 7-12.

American Academy of Periodontology, Chicago, August 3-5.

American Board of Orthodontia, Oklahoma City, Okla., November 6-7.

American Dental Society of Europe, Holland, August, 1934.

American Full Denture Society, Chicago, August 6-7.

American Society for the Promotion of Dentistry for Children, Chicago, August 7.

American Society of Oral Surgeons and Exodontists, Chicago, August 4-5.

American Society of Orthodontists, Oklahoma City, Okla., November 8-10.

Association of American Women Dentists, Chicago, Ill., August 7.

Association of Military Dental Surgeons, Chicago, August 8.

Greater New York December Meeting, New York City, December 4-8.

International Congress of Radiology, Zurich, Switzerland, July 24-31, 1934.

Society for Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

National Association of Dental Examiners, Chicago, August 7.

American Dental Assistants Association, Chicago, August 7-12.

American Dental Hygienists' Association, Chicago, August 7-12.

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

STATE BOARD OF DENTAL EXAMINERS

California, at San Francisco, December 11. K. I. Nesbett, Secretary, State Bldg. Annex, San Francisco.

GREATER NEW YORK DECEMBER MEETING

The ninth annual Greater New York December Meeting will be held at the Hotel Pennsylvania, New York City, December 4-8, under the auspices of the First and Second District Dental Societies of the State of New York.

CARROLL B. WHITCOMB, *Chairman,*
Organization Committee.

AMERICAN BOARD OF ORTHODONTIA

The fourth annual meeting of the American Board of Orthodontia will be held in Oklahoma City, Okla., at the Biltmore Hotel, November 6-7. Those orthodontists who desire to qualify for a certificate from the board should secure the necessary application form from the secretary. Applications received up to the date of the meeting in Oklahoma City will receive preliminary consideration by the board and the required examination will be outlined. It will not be necessary for new applicants to appear before the board at this time. Such applicants should appear before the board at the next annual meeting. Attention is called to the following resolutions adopted by the board: Any person desiring to make application to the board for a certificate shall have been in the exclusive practice of orthodontia for a period of not less than five years or an equivalent to be determined by the board and based on the following conditions: (1) an instructorship in orthodontia in a school satisfactory to the board; (2) a position as associate in the office of an orthodontist whose standing is satisfactory to the board. It is to be understood that any person at the time of making application for a certificate shall be in the exclusive practice of orthodontia in his own name.

OREN A. OLIVER, *Secretary,*
Medical Arts Bldg.
Nashville, Tenn.

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*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

AMERICAN SOCIETY FOR THE ADVANCEMENT OF GENERAL ANESTHESIA IN DENTISTRY

The next meeting of the American Society for the Advancement of General Anesthesia in dentistry will be held October 23 at 22 E. 38th St., New York City, with a dinner at 7 p. m., followed by an address by Anthony Bassler, M.D., at 8:30.

HARRY J. FIELD, *Secretary*,
130 Market St.,
Newark, N. J.

ASSOCIATION OF AMERICAN WOMEN DENTISTS

The Twelfth Annual Meeting of the Association of American Women Dentists will be held at the Stevens Hotel, Chicago, August 7. An invitation is extended to all women dentists.

GENEVA E. GROTH, *Chairman*,
Publicity Committee,
1301 Medical Arts Bldg.
Philadelphia, Pa.

STATE OF CALIFORNIA BOARD OF DENTAL EXAMINERS

The next examination for the purpose of obtaining a license to practice dentistry in the State of California will be held in San Francisco, December 11. For further information, address

K. I. NESBITT, *Secretary*,
State Bldg. Annex,
San Francisco.

MARYLAND STATE DENTAL ASSOCIATION

The semi-annual meeting of the Maryland State Dental Association, in celebration of the fiftieth anniversary of the founding of the association will be held at the Lord Baltimore Hotel, Baltimore, October 30-31. The scientific program will depict the evolutionary progress of dentistry during the last fifty years, the essays being of historical interest. All members of the American Dental Association are invited to attend.

WALTER L. OGGESEN, *Secretary*,
Baltimore.

POSITIONS ON HOSPITAL STAFF AVAILABLE

The reorganization of the dental staff of the Bronx Hospital permits a number of appointments to be made in the various departments of dentistry. Applications may be made to the Bronx Hospital, Fulton Avenue at 169th St., Bronx, N. Y.

DAVID WURZEL, *Chief of Clinic*.

DEATH OF DR. EDWARD C. KIRK

Just as we go to press we learn with regret of the passing of Dr. Edward C. Kirk, late editor of the *Dental Cosmos*. A more extended notice will appear in our next issue.

TRANSPORTATION INFORMATION

The following information relative to fares, etc., is subject to change at any time.

RAILROADS

On account of A Century of Progress International Exposition to be held in Chicago from June 1 to November 1, 1933, all railroads have authorized reduced rates to Chicago. Those contemplating attendance at the Seventy-Fifth Annual Session of the American Dental Association, in conjunction with which will be held the Chicago Centennial Dental Congress, will benefit by these substantially reduced rates, which are even more advantageous than the usual convention rate of a fare and one-half.

To secure the latest information on rates, train schedules and accommodations, communicate with the nearest local ticket agency a week or more prior to departure.

AUTOMOBILES

There will be available for general distribution in the near future an official highway map of A Century of Progress. These maps are being distributed by member clubs of the American Automobile Association. It is contemplated they also will be available at filling stations throughout the country.

TOURISTS' CAMPS

Developments are in progress for the erection and operation of tourists' camps and parking lots in the outskirts of the city to accommodate the motorists who do not desire

hotel accommodations. It is planned to locate these camps adjacent to the main highways leading into Chicago and also adjacent to some section of the city's established transportation systems. This will enable the motorist to secure comfortable living quarters and protected parking space in the suburban areas.

Rates for tourist cabin accommodations will probably be established at $1.00 or $1.25 per person per night, with cheaper rates for groups and for longer periods of stay.

For descriptive illustrated folders address: Allen Tours, Inc., 333 N. Michigan Avenue, Chicago, or Century Cabin Camps, Inc., Suite 900, 7 South Dearborn Street, Chicago.

AUTOMOBILE PARKING

The Chicago Loop district garage and open-air parking stations, with their limited facilities, will be unable to accommodate the enormous daily influx of cars during the World's Fair. As a convenience to members, attention is called to a company that will operate a huge parking terminal with accommodations for 20,000 cars, located about fifteen minutes from the Stevens Hotel. For a very limited time this company will accept advance reservations at attractive minimum rates. If interested in this service, apply at once to the Anthony Wayne Oil Corporation, 215 W. Randolph Street, Chicago, for folders with all particulars, including a map.

AIR LINES

The one way fares applying on air lines are now equivalent to approximately rail plus pullman rates, with a 10 per cent reduction on round trips. Most fares contemplate service on multimotored airplanes, and include all travel costs excepting ground transportation; also in most cases luncheons are served while aloft. *Reductions in fares and other changes undoubtedly will be made during the entire summer.* Detailed information may be obtained at any air line office.

BUS LINES

Practically every city, hamlet and village is now served by this mode of transportation, which is usually 25 per cent below railroad rates. Reduced round trip fares with a time limit of sixty days will be in effect. Going and returning by diverse routes will be optional at no extra cost. *Additional reductions in fares undoubtedly will be made during the entire summer.* Consult your local agent for latest schedule on information and fares.

LAKE TRAVEL

Great Lakes Steamship 1933 Sailing Schedules have been rearranged to provide more frequent service from all important ports. One way and round trip fares (including transportation, meals and berth) from Buffalo, Cleveland, Detroit and Duluth to Chicago are the lowest in history. Rail tickets reading via any railroad between various ports will be honored for transportation. Adjustments for meals and berth will be made by the purser aboard the steamship. Automobiles are carried at reasonable rates.

For further information apply at any steamship office.

OCEAN TRAVEL (EUROPE)

Visitors from abroad will find ocean transportation rates a real inducement to attend the Diamond Jubilee of the American Dental Association in conjunction with the Chicago Centennial Dental Congress and A Century of Progress. Reduced railroad rates (read instructions under "Railroads") will apply from all ports of entry to Chicago.

For sailing schedules, reservations, etc., see your local steamship agent.

C. H. H. Brevig, *Chairman*
Local Transportation Committee

SPECIAL NOTICE ON R.R. TRANSPORTATION

Members who find it advantageous to purchase "convention certificate plan" tickets at one fare and one-third rate should present them for validation at the transportation desk. Provided the required number of certificates are validated, the return journey can be made for one-third the regular fare.

Consult your local ticket agent for lowest rates. C. H. H. Brevig

HOTELS

HOTEL	Single with Bath	Double with Bath	Twin Beds with Bath
ALLERTON 701 N. Michigan Ave.	$ 2.50 up	$ 3.00 up	$ 3.50 up
AMBASSADOR State and Goethe Sts.	3.50- 6.00	4.00- 8.00	
*ATLANTIC 316 S. Clark St.	2.50- 4.00	4.00- 6.00	
*AUDITORIUM Congress and Michigan Ave.	3.00	5.00	
BELMONT 706 W. Madison St.	4.00- 8.00		5.00-10.00
BERKSHIRE 15 E. Ohio St.	2.50 up	3.50 up	5.00
*BISMARCK 171 W. Randolph St.	3.00- 6.00	4.50- 8.00	5.00-10.00
*BREVOORT 120 W. Madison St.	2.50	3.50	
BROADVIEW 5540 Hyde Park Blvd.	2.00- 3.00	2.50- 5.00	4.00- 5.00
COMMONWEALTH 2757 Pine Grove Ave.	2.00- 2.50	4.00- 6.00	
*CONGRESS S. Michigan Ave. and E. Congress St.	3.00-10.00	6.00-12.00	6.00-12.00
CROYDON 616 Rush St.	21.00 wk.	28.00 wk.	
DALTON 1234 S. Wabash Ave.	2.00 up	3.50 up	
DEL PRADO 5307 Hyde Park Place	3.00- 7.00	5.00-8.00-9.00	
DRAKE Lake Shore Dr. and Michigan Ave.	3.00 up		5.00
EASTGATE 162 E. Ontario St.	2.50- 3.50	4.00- 5.00	4.50- 6.00
EDGEWATER BEACH 5349 Sheridan Road	3.00- 8.00	5.00-10.00	
FAIRFAX 1369 Hyde Park Place	Kitchenette	3.50 up	Double 4.00 up
FLAMINGO 5520 South Shore Drive	4.00	7.00	
*FORT DEARBORN 125 W. Van Buren St.	2.45	2.95- 3.45	Single W.O.B. 1.95
GEORGIAN 537 Deming	3.50	5.00	
GRAEMERE 113 N. Homan Blvd.	3.00	5.00	
*GREAT NORTHERN 237 S. Dearborn St.	2.50- 4.00	3.50- 6.00	
HAYES 6345 University Ave.	2.50	3.50	
HYDE PARK Hyde Pk. and Lake Pk. Aves.	2.50- 4.00	3.50- 5.00	
HARRISON 57 E. Harrison St.	2.50- 3.00	3.50- 4.00	4.50- 5.00
KNICKERBOCKER 163 E. Walton Place	3.00- 5.00	5.00- 6.00	7.00- 8.00
LAKE SHORE DRIVE 181 Lake Shore Drive	5.00 up	7.00- 8.00	7.00 up
*LA SALLE La Salle and Madison Sts.	3.00	4.50	6.00- 7.00
LAWRENCE 1020 Lawrence Ave.	1.50 up	2.50 up	2.50 up

*In "Loop." Other hotels listed are easily accessible from the Stevens (headquarters) and the World's Fair Grounds.

HOTELS

HOTEL	Single with Bath	Double with Bath	Twin Beds with Bath
LORRAINE 411 S. Wabash Ave.	$ 1.50- 2.50	$ 2.00- 4.00	$17.50 wk.
*MAJESTIC 29 Quincy St.	1.50- 5.00	2.50- 6.00	
MARYLAND 900 Rush St.	2.50	4.00	5.00
*MORRISON 79 W. Madison St.	3.00- 5.00	4.50- 7.00	5.00- 8.00
NORTH SHORE HOTEL Evanston	3.50 up	5.00 up	
ORRINGTON Evanston	4.00- 5.00	4.00- 5.00	
*PALMER HOUSE State and Monroe Sts.	3.50- 6.00	6.00-10.00	6.00-10.00
PARK LANE 2842 Sheridan Road	4.00	5.00- 6.00	
PEARSON 190 E. Pearson St.	3.00 up	5.00 up	
PLAZA 1553 N. Clark St.	2.00 up	3.00 up	3.50 up
RIDGEVIEW Evanston	3.00	5.00	
RIENZI 600 Diversey Parkway	2.00 up	3.00 up	
ROGERS PARK 6805 Sheridan Road	3.00	5.00	
SENECA 200 E. Chestnut St.	3.00- 4.00	4.00- 5.00	
SHERIDAN-PLAZA 4605 Sheridan Road	2.50	4.00	
SHERMAN Clark and Randolph Sts.	3.00- 5.00	4.50- 7.00	5.00- 8.00
SHORELAND 5454 South Shore Drive	4.00 up	6.00 up	6.00 up
ST. CLAIR 162 E. Ohio St.	3.00- 4.00	4.00- 6.00	Suites 10.00
SOUTHMOOR 6646 Stony Island Ave.	2.50	4.00	
SOVEREIGN 6200 Kenmore Ave.	3.00- 5.00	4.00- 6.00	
STEVENS 7th and Michigan Ave.	3.00- 6.00	4.00-10.00	6.00-12.00
STOCK YARD INN W. 42nd and S. Halsted Sts.	2.00- 3.00	4.00 up	
VERSAILLES 5234 Dorchester Ave.	2.00	3.50	Kitchenette 2.50
VICTORIA 334 South Clark St.	2.50 Single W.O.B. 1.50	4.00 Double W.O.B. 2.50	Restaurant in Connection Moderate Prices
WACKER 109 W. Huron St.	2.00- 3.00	3.00- 4.00	4.00- 5.00
WARNER 3301 Cottage Grove Ave.	2.00	3.00	
WINDERMERE 1642 E. 56th St. West East	2.50- 5.00 3.50	4.00- 7.00 5.50	

The demand for hotel accommodations during A Century of Progress will be great. For this reason everyone planning to attend is urged to make room reservations as early in advance as possible. Hotels listed here are members of the Chicago Association of Commerce and the Chicago Hotel Association and guarantee that the above rates will prevail during A Century of Progress Exposition.

PACKAGE LIBRARIES*

Compiled by and Available for Circulation

from the

LIBRARY BUREAU

of the

AMERICAN DENTAL ASSOCIATION

212 East Superior Street, Chicago, Ill.

†Abnormal secretion of saliva.
Absorption of roots and bone.
†Actinomycosis of head and neck.
†Agranulocytic angina.
Alveolar process—its structure, anatomy and resorption.
Alveolectomy
Amalgam fillings and physical properties of amalgam.
Anesthesia—discovery and early uses.
†Anesthetics in children's dentistry.
Angle's orthodontic appliances.
Apicoectomy.
Articulation, occlusion and mandibular movements.
Bacteria of the mouth.
Bacteriological studies of root canals.
Best time for orthodontic treatment.
Biographies of dentists
Blood count in focal infection.
Bogue's articles from Dental Digest.
†Bridges using inlays as abutments.
Broken needles
Bureau of Standards reports.
Business side of dentistry.
Calcium metabolism.
Cancer of mouth.
†Carbon dioxide administered in conjunction with nitrous oxid-oxygen anesthesia.
†Cast gold crowns.
Cast gold inlays
Casting gold, including inlays and dentures.
Cavity preparation
†Cementation of inlays
†Child psychology.
Children's dentistry.
Clasps—wire and cast

*Each package library contains information on one of the subjects listed and is composed of reprints, magazine clippings, etc., on that subject only. The packages are loaned to members of the Association for a period of one week after date of receipt. Unless the material is reserved for another borrower, an extension of time will be granted on request.

The rental fee for borrowing a package library is 50 cents. This fee must accompany the request for a package library. No packages are sold. In response to requests, packages will be compiled on other subjects pertaining to dentistry.

†This package contains less than the usual number of articles.

Cleft lip and palate—etiology and surgical treatment.
†Cleft palate—orthodontic treatment and prosthetic appliances.
Community and school dental service.
Comparative dental anatomy.
Conduction anesthesia.
Condyle path movements.
†Congenitally missing teeth.
Contributions dentists have made outside their profession.
†Curetting.
Cysts and tumors of mouth.
Dental assistants.
Dental care of the preschool child.
Dental caries.
Dental cements.
Dental clinics.
†Dental disease and practice in the tropics.
Dental economics.
Dental education.
†Dental erosion.
Dental ethics.
Dental health education.
Dental hygienists.
Dental libraries.
Dental metallurgy.
†Dental nomenclature.
Dental service in the World War.
Dental technicians.
Dentifrices.
Dentistry as a career and the status of the dentist.
†Dentistry in foreign lands.
Dentistry of the time of George Washington.
Denture bases—discussion of materials.
Denture casting.
Diathermy in dentistry.
Diet and nutrition in relation to teeth.
Diet in pregnancy.
Diseases of the tongue.
Dry socket.
Education of denture patients.
†Emphysema.
Enamel—decalcification and recalcification of.
Endocrine glands in relation to teeth.
†Epithelial débris.
†Eruption of teeth—dates of eruption and accompanying symptoms.
†Eruption of teeth—theories regarding.
Esthetics in denture construction.
Ethyl chlorid.
Ethylene anesthesia.
Etiology of caries.
Etiology of malocclusion and preventive orthodontia.
Etiology of pyorrhea and its relation to systemic conditions.
Evolution of human dentition.
Examination of the mouth and oral diagnosis.
Extraction of teeth.
†Facebow technic and recording of occlusion.
Fauchard's (Pierre) life.
Fixed and removable bridgework.

Fixed bridgework.
Focal infection.
†Focal infection and arthritis.
†Focal infection and oral sepsis in relation to gastro-intestinal disturbances.
Focal infection in relation to diseases of the eye.
Foreign bodies (of dental origin) in the lungs and esophagus.
Fractures of the jaws.
Full denture construction.
†Gagging.
Gillett and Irving's articles on indirect inlay technic.
Gold foil.
Growth and development of teeth and jaws.
Habits as factors in malocclusion.
Hemophilia or excessive hemorrhage following extraction.
Hereditary influences in malocclusion.
†Histologic examinations of fractured roots.
Histologic study of teeth and tissues.
Histology of peridental membrane.
History and progress of dentistry.
History of dental education in U. S.
History of dentistry.
†History of full denture construction.
Hospital dental service.
†Hypercementosis and excementosis.
†Hypnotism.
Immediate denture service.
Impacted teeth and their removal.
Impacted third molars.
Implantation, replantation, transplantation of teeth.
Impression materials and technic.
†Impression taking for cast gold inlays.
Impression technic.
Indirect inlay technic.
Industrial dental service.
Influence of deciduous teeth and first permanent molars on occlusion.
Influence of dental improvements on appearance and mental conditions.
Influence of diet on saliva.
Interpretation of roentgenograms.
Investment compounds and technic.
Ionic medication.
†Jackson's (V. H.) articles on orthodontic appliances.
†Labial frenum.
Lectures to nurses.
Lesions of the mouth.
†Leukemia.
†Leukoplakia.
Local anesthesia.
Local anesthesia—contraindications and untoward results.
Lower denture construction.
†Ludwig's angina.
Malpractice in dentistry.
Materia medica and pharmacology.
†Matrix.
Maxillary sinus and antrum—diseases and treatment.
Methods of sectioning and staining teeth.
Monson's theory.
Mottled enamel.

Mouth hygiene.
Muscle exercises and training in orthodontia.
Nitrous oxid-oxygen analgesia.
Nitrous oxid-oxygen anesthesia.
Occlusion in partial dentures.
†Occlusion in relation to operative dentistry.
†Opening the bite.
Oral diagnosis with reference to roentgen ray.
Oral manifestations of systemic conditions.
Organized dentistry
Orthodontia and its relation to dentistry and medicine.
†Orthodontic anchor bands.
Orthodontic appliances.
Orthodontic diagnosis and measurements.
†Orthodontic treatment of impacted cuspids.
Osteomyelitis of the jaws.
"Panel" or insurance dentistry.
Partial dentures.
†Permeability of tooth structures.
Physical therapy in dentistry.
†Pinledge and pinlay attachments.
Place of extraction in orthodontic treatment.
Plastic surgery.
Pollia's articles on radiology.
Porcelain in dentistry.
Porcelain inlays.
Porcelain jacket crowns.
Postoperative complications and care.
†Postoperative psychosis.
Pregnancy and dental disease.
Preoperative examination of patients.
Preparation of cavities with hypersensitive dentin.
Preventive dentistry.
Procain (novocain) dermatitis.
†Program building for state and district societies.
Prophylactic odontotomy.
†Pulp amputation.
Pulp conservation including pulp capping and cavity lining.
†Pulp pathology.
†Pulp stones.
Pyorrhea.
Relation between dental conditions and the mental health of insane.
Relation of the dentist to the physician.
Removable bridgework.
†Removable bridgework—discussing various types of attachments.
Research Commission reports.
Restoration of oral functions including opening the bite.
Retainers used in orthodontia.
Retention of deciduous teeth and delayed eruption of permanent teeth.
†Retrusion of the mandible causing impaired hearing.
†Roofless dentures.
Root canal treatment.
†Salivary calculus.
†Salivary glands.
†Shock, syncope and collapse.
Should dentistry be advertised?
Silicate cements (see dental cements).

†Silver nitrate.
†Smith's articles on oral prophylaxis.
†Space retention—its importance and methods of accomplishing.
†Speech defects and training.
†Status lymphaticus.
Sterilization of dental instruments.
Stomatologic program (A.S.S.).
Stomatology—general discussions of.
Stories and rhymes for children.
Studies of saliva.
Suggestions for talks to mothers.
Suggestions for talks to students.
†Supernumerary teeth.
Surgical treatment of pyorrhea.
Syphilis in relation to dentistry.
Three-quarter crowns.
Tooth arrangement for full dentures.
Toothbrushes and toothbrushing technic.
Toothbrushes, tooth pastes and mouth washes.
†Torus palatinus
Transplantation of teeth (see implantation of teeth).
Traumatic occlusion.
Trigeminal neuralgia.
Trismus and ankylosis.
Tuberculosis and dentistry.
Ultraviolet ray in the treatment of pyorrhea.
Ultraviolet ray therapy in dentistry.
Undergraduate and graduate orthodontic education.
Use of elevators in extraction.
Value of dental service in schools.
Value of roentgen-ray examinations in orthodontia.
Various studies of or pertaining to saliva.
Vincent's infection.
Vulcanite and vulcanite stomatitis.
Waxes and wax expansion method.
†Willett's articles.

PAMPHLETS ON DENTAL ECONOMICS AVAILABLE FROM LIBRARY BUREAU

Through the courtesy of the Julius Rosenwald Fund, copies are available of the studies entitled "Dental practice and income," by Maurice Leven and "Status of dentistry in our economic system," by Michael M. Davis. Dr. Herbert E. Phillips has likewise contributed copies for distribution of Thomas D. Eliot's "Trends in health care in relation to social-economic conditions." All of these studies may be obtained by writing to the Library Bureau of the American Dental Association, 212 E. Superior Street, Chicago, Illinois, and enclosing postage. Three cents postage is required for all three pamphlets or one and one-half cents for one or two of them. The three pamphlets together cover such topics as: Fees charged for various services, time spent in professional work, income from and expenses of dental practice, percentage of family income expended for dental care, ratio of dentists to population, etc.

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1932-1933

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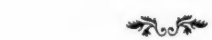

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And note how a small amount of cleaning preparation with slow speed on your engine really goes to work in a BS Polisher; how BS Polishers clean the **neck** of the teeth and much of the **proximal** surfaces. Do not overlook the **appreciation** of the **patient** for your gentleness and lack of pain or discomfort.

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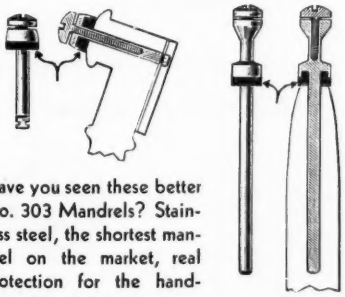

Have you seen these better No. 303 Mandrels? Stainless steel, the shortest mandrel on the market, real protection for the handpiece in a neat way.

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BURS recut perfectly and assorted in 1 dozen stamped packages—with this advertisement $1.80 per gross. Handpieces repaired reasonable. Many approvals on hands. SHEUN & CO., 6612 Sheridan Rd., Chicago. Established 1906.

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WANTED: to purchase used complete dental unit, or tri-dent, with or without engine. Give particulars and best price. Address A3041, American Dental Association, 212 E. Superior St., Chicago, Ill.

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FOR SALE—Transactions of the American Dental Association for the years 1912, 1913, 1917, 1918, 1919, 1920, 1921, 1922, 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, and 1931, at $1.00 per copy. As there are only a few available, orders will be filled as long as they last in the order in which they are received. Address A1499, care American Dental Association, 212 E. Superior St., Chicago, Ill.

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Special notice to dentists: We now have a new **Dental Emblem** for your car. It fits above the license plates making it more easily seen. If you are a member of the local, state, or A.D.A. societies, you should order your **Dental Emblem** now. Special rates available to dental societies or in quantities. Literature and colors available free upon request. Write today. $3.00

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Make the Journal your "Buyers' Guide"

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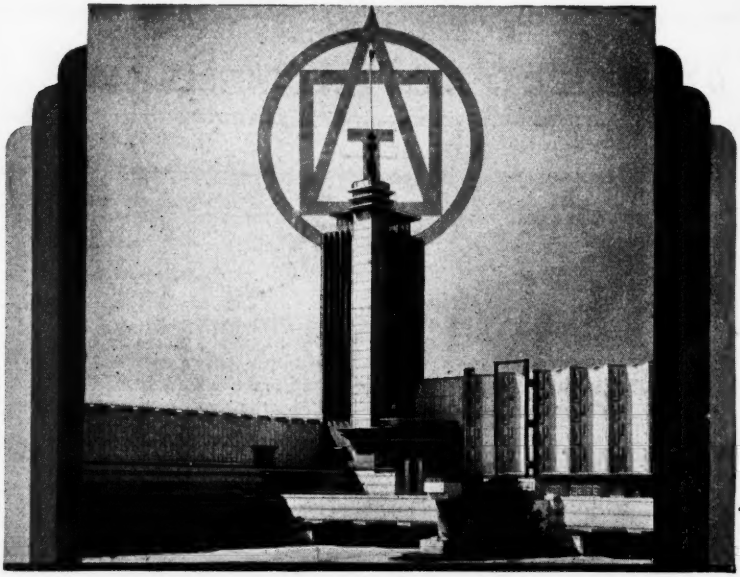

HALL OF SCIENCE AT CENTURY OF PROGRESS INTERNATIONAL EXPOSITION, WHERE NEW TRUBYTE EXHIBIT WILL BE ON DISPLAY.

Combine a Scientific Treat With a Vacation— *AT CHICAGO*

WE INVITE YOU TO VISIT our Exhibit in the Hall of Science, Century of Progress, Chicago, this summer. (You might allow time before or after the A. D. A. meeting, August 7-12.)

In addition to the educational and scientific features of the A. D. A.'s meeting you will have spread before you the vast exhibits of the Century of Progress International Exposition, gathered from every corner of the world.

Typifying the progress in your own profession will be the New Trubyte Exhibits at the A. D. A.'s meeting and at the Hall of Science in the Exposition Grounds.

We look forward to your visiting both

THE DENTISTS' SUPPLY COMPANY OF NEW YORK

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